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Section for the Study of Disease in Children.

President—Dr. J. D. Rolleston.

CASES.

Trichotillomania in Typhoid Fever.

By J. D. Rolleston, M.D. (President).

Boy, aged 10 years, backward mentally and undersized. Height 3 ft. 11 in. (normal 4 ft. $3\frac{3}{4}$ in.), weight 4 st. $5\frac{3}{4}$ lb. (normal 4 st. $11\frac{1}{2}$ lb.); opacity of left cornea following chickenpox at 2 years and left internal strabismus. No history of epilepsy or night terrors. Two other children in the family, both girls, one normal, aged 18, the other, aged 15, in an asylum.

The patient developed the habit of pulling out the hair from his scalp at the end of the second week of a moderate attack of typhoid fever, just as the temperature was beginning to fall; he dug his nails furiously into the scalp causing it to bleed and afterwards to suppurate. He was never delirious. The habit continued for about a month (during a fortnight of which the temperature was normal) and could only be prevented by putting both arms in splints. There was no local source of irritation in the scalp and the hair showed no evidence of ringworm. It is now about two months since he has pulled out any hair from his scalp, but he has recently been seen to pull out some of his eyelashes. The scalp in the left fronto-parietal region shows a pigmented area (measuring 3 in. × 2 in.) of alopecia resembling that caused by X-ray treatment of ringworm. The eyelashes of the left upper lid are less numerous than those of the other lids and some are broken.

This condition corresponds fairly well with that which has been described by the French dermatologist Hallopeau,[1] in 1889, under the name trichotillomania. The first cases he described were in adults, but several have been described in children, not so much in Anglo-Saxon countries as in French, German and Italian races (Harper[2]). In some cases this tic—Raymond describes it as a "tic d'épilation"—is associated with other tics, such as onychophagia; and Cruchet, of Bordeaux, has described a case associated with peotillomania (plucking at the penis)[3]; some cases have been associated with sex perversion.[4] Most of the cases have been recorded by dermatologists.

Discussion.—Dr. F. Parkes Weber referred to the case of an adult man whom he saw some time ago and who apparently had a kind of trichotillomania. This patient had been told to pluck hairs out of his face, probably on account of slight sycosis, but he continued this epilation when there was no evidence of disease, apparently mistaking the normal appearance of the hair-roots for something pathological. In regard to Dr. Rolleston's present case he (Dr. Weber) thought the trichotillomania was of the nature of a habit "tic" in a slightly mentally deficient child. He suggested keeping the hair of the whole scalp so short

1 *Ann. de Derm. et de Syph.*, 1889, x, 440.
2 *Journ. Cut. Dis.*, 1916, xxxiv, 363.
3 *Gaz. hebd. Sci. méd. de Bordeaux*, 1909, xxx, 74.
4 Furmann, *Monatschr. f. Psych. u. Neurol.*, 1902, xi, 231; Pernet, *Rep. Soc. Study Dis. Child.*, 1905, v, 28.

that the patient could not pull any out. If this were continued for a considerable time the boy might forget his bad habit and thus become free from it. It would, however, not be surprising if the boy, as he was of rather low mental grade, developed some other tic in place of the trichotillomania.

Dr. ROLLESTON (in reply) said that so far as he could find from the literature, no previous case had been recorded in an acute infection.

Atresia of the Duodeno-jejunal Junction.

By BERNARD MYERS, C.M.G., M.D.

THIS case is interesting because of the rarity of the condition. A case of congenital occlusion of the intestine was described in 1793, and a contribution was made to the literature of the subject in 1877, but still the number of cases recorded is not large.

On December 22, 1926, a female infant 5 days old (F.) was admitted into the Royal Waterloo Hospital with the following history, for some of which I am indebted to Dr. Jaecques.

The baby was born three weeks prematurely. The birth appears to have been natural. The weight was 4 lb. It was the first child and there was no history of miscarriages. The baby was breast-fed for a day or two and then fed on a milk mixture. On the third day after birth the child was markedly jaundiced all over the skin and the conjunctivæ, and on the same day bile-stained vomiting began. The vomiting occurred sometimes directly after food, at other times within half an hour; it was frequent and often accompanied by hiccough. Nothing abnormal was discovered in the epigastric region, but occasional peristalsis was observed. Stools were passed on the third day which were stated to resemble meconium, but on the fourth day they were apparently yellow. The stool I saw was very tiny and yellowish-grey; it was sent to the Pathological Department for examination, but unfortunately was lost.

The child died a few hours after admission to hospital. Before death the jaundice became more marked. On the previous day the temperature was normal, the pulse 160, and respirations 40.

Although the diagnosis of atresia of the intestine was not definitely made it was kept before us as a possibility.

Necropsy.—The infant was very jaundiced and looked "dried-up." The stomach was distended, the duodenum distinctly so, and a small portion of the jejunum, the duodenum appearing to be about the size of the stomach. The duodenum was filled with bile-stained fluid. It ended blindly, the atresed end being quite free from the lower portion of the jejunum which was about 1 in. distant. The diameter of the stomach and duodenum was about 1 in. The intestines below the gap were small, but apparently patent, the diameter being about an eighth of an inch. The anus was patent. Dr. Rosher was of opinion that the liver and gall-bladder were normal, and no other abnormality was discovered.

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Description of Specimen by T. W. P. Lawrence, F.R.C.S., of the Royal College of Surgeons.

"Small bowel, 4 in. long by 1¼ in. wide. Stomach, 2 in. long by 1½ in. wide. Stomach hypertrophied and moderately dilated. Stomach bowel hypertrophied and greatly dilated, especially at distal part. Blood-vessels normal. No scar or fibrosis at fundus of small bowel. Defect probably at duodeno-jejunal flexure. Gall-bladder and ducts normal."

C. W. M. Poynter and D. L. Davis writing in the *Journal of Surgery, Gynæcology and Obstetrics* in 1922, on congenital occlusions of the intestines, stated that congenital occlusion may appear at any point of the intestinal canal and is found about once in 20,000 infants; in their series it was multiple in 15 per cent. Apparently the imperforate anus is four times as frequent as other intestinal atresias.

In their series the position of the atresia was stated to be in the duodenum, above papilla in 59 cases; duodenum, below papilla 75 cases; jejunum, 60 cases; ileum and cæcum, 101 cases; colon, 39 cases; multiple atresia, 67 cases. Of the multiple cases slightly more than 50 per cent. consist of from 2 to 9 occlusions in the jejunum and upper ileum.

Surgical treatment as early as possible after birth is the only chance of cure, but as the diagnosis is frequently not made very few indeed of these children live for more than a few days and the operations performed with an occasional exception have been fatal.

Sir John Bland-Sutton's theory that occlusion occurs at the site of an embryological event is most interesting and it is possible that such may be the case in this instance, the occlusion here occurring at the junction of the fore and mid guts. Other causes have been described, such as persistence of fœtal overgrowth of epithelium in the duodenum, also syphilitic disease; or there may be strangulation of the bowel, intussusception, volvulus, peritonitis or ulceration of the bowel.

Discussion.—Dr. R. C. JEWESBURY said he had had four cases of this kind, previously recorded. Two of these were cases of true atresia, one complete, and one in which the narrowing of the duodenum was such that it would just admit a fine probe. The others were not true atresia, they were due to bands compressing the duodenum from the outside. The first case had appeared to be one of pyloric obstruction, though the infant was only ten days old. There was definite peristalsis, and the vomiting was projectile, as in pyloric obstruction. The vomit, however, was bile-stained, an unusual feature in pyloric obstruction. The diagnosis was furnished by X-ray examination; the skiagram showed a large dilated stomach, and a dilated first portion of duodenum. The pylorus itself was also dilated, as was the upper part of the duodenum. He said that Mr. Max Page had operated in two of the cases, and in the case in which the obstruction was due to a peritoneal band, when the band had been divided the child had made a good recovery. Had the symptoms in Dr. Myers' case suggested any pyloric obstruction?

Dr. BERNARD MYERS (in reply) said he had omitted to state that in this case the arteries were normal, therefore no sclerotic condition of arteries with secondary degeneration of the mucosa entered into the question, as it did in one reported case. He had been interested in the experience related by Dr. Jewesbury. When a band, recently formed, was the cause, there was a possibility of recovery. With regard to the symptoms, the vomiting was said to be forcible, but not so forcible as in hypertrophic stenosis of the pylorus; the material vomited was bile-stained from the third day. Peristalsis was present, but not so obvious as in hypertrophic pyloric stenosis. The child was obviously emaciated. There was a fullness in the abdomen which might have suggested stenosis of the pylorus, but the symptoms did not favour that diagnosis, nor was a hypertrophied pylorus discovered.

Splenectomy for Essential Thrombocytopenic Purpura Hæmorrhagica.

By Bernard Myers, C.M.G., M.D.

W. B., A GIRL, aged 10 years, was admitted to the Royal Waterloo Hospital, in July, 1925, for bleeding from the gums and nose, and purpuric spots on the body and limbs. There were also several bruises present. These were stated to appear either from slight pressure or without any accountable cause. She had suffered from purpura for about a year. There was no similar case in the family. With the exception of the purpura the patient was a healthy, well-developed girl. The spleen was just palpable. There was a tendency to constipation. No history of melæna was obtained. The tonsils were a little enlarged.

The coagulation time of the blood was ninety seconds, but the bleeding time was twenty minutes, the normal being two to three minutes. Dr. Knyvett Gordon kindly examined the blood and found the erythrocytes to be 4,900,000; the hæmoglobin 50 per cent.; colour index = 0·5. The white cells in July, 1925, were 16,250, but in November the same year there were 4,800. The blood platelets were markedly diminished, only two being seen in each whole slide while the control test on a normal person showed 300,000 per c.mm. Leucoblasts 3 per cent., lymphoblastic plasma cells 2 per cent., and anisocytosis and poikilocytosis marked. The capillary resistance test was positive. The great diminution of blood platelets, the increased bleeding time, and the positive capillary resistance test showed this case to be one of essential thrombocytopenic purpura hæmorrhagica.

Treatment by administration of calcium salts and serum injections and transfusion of blood was tried, but without much success; the blood-transfusion, however, was of distinct use for a short time, but the bleeding recurred. Bleeding from the gums had continued for many weeks without cessation when I asked my colleague, Mr. Rodney Maingot, to perform splenectomy. This he did on November 13, 1925.

Since the splenectomy sixteen months ago the patient has not had any recurrence of purpuric spots either on the skin or mucous membranes, and has remained in splendid health. Two teeth were taken out last June and the dentist stated that the bleeding from the sockets was just normal and quickly stopped. Previous to operation she used to bruise easily, but does not do so now.

On March 10, 1926, the blood platelets numbered 479,200 per c.mm.; red blood-cells 4,900,000; hæmoglobin 60 per cent.; colour index 0·6. The white blood-cells were 8,100. Poikilocytosis and anisocytosis were present as before the splenectomy. The capillary resistance test was negative after three minutes on March 11, 1927, and the blood clotted in three minutes in the bleeding time test.

Some practitioners consider that splenectomy is hardly ever required and that there are other simpler ways of successful treatment. In a case like the present I believe splenectomy to be most likely to be successful; the operation mortality has been stated to be 5 per cent., but there seems no reason why that figure should not be reduced.

Discussion.—Dr. J. D. Rolleston (President) said he thought the triumvirate concerned with this case—the physician, Dr. Myers, the pathologist, Dr. Knyvett Gordon, and the surgeon, Mr. Maingot—were to be congratulated on the result. An equally successful case of splenectomy in Henoch's purpura, the first example of the kind on record, had recently been reported.[1]

[1] *Brit. Journ. Child. Dis.*, 1926, xxiii, 241.

Dr. W. M. FELDMAN asked if Dr. Myers could explain the sudden stoppage of the hæmorrhage on clamping the splenic arteries. If the bleeding had been due to something connected with the spleen, the result would not probably have been so dramatic. If clamping caused such a result, why perform splenectomy?

Dr. MYERS (in reply) said the question was most difficult to answer. All he could suggest was that there was something in the spleen which allowed the permeation of blood from the tiny vessels. But for the bleeding to cease so quickly on the clamping of the splenic vessels was, he admitted, extraordinary. In his other two cases there had not been an immediate cessation, but oozing had quite stopped within a few hours. The blood-platelets were enormously increased in twenty-four hours.

In answer to Dr. Feldman's last remark, he did not understand the idea of clamping the splenic vein and leaving the spleen; such would surely be a dangerous practice. An interesting point was how much of the reticulo-endothelial system was left to carry on the work of the body.

Dislocation of Cervical Vertebra as Result of a Fall.

By D. C. L. FITZWILLIAMS, C.M.G., F.R.C.S.

THE patient, S. M., aged 6½ years, was admitted to hospital February 22, 1926, complaining of pain in the back of the neck and left arm, following a fall in the playground six days previously. He seemed afraid to let anyone touch his head or neck, and walked about with his hand on the back of his neck. There were no symptoms of sphincter disturbance or other cord symptoms.

Examination.—All movements of neck limited, especially flexion and rotation to left.

X-ray, February 22, 1926, showed "dislocation forwards of the atlas on the epistropheus, odontoid process not seen."

March 2, 1926.—Neck manipulated under anæsthetic. Traction by sling passing beneath mandible and occiput. Distinct snap felt. Temperature 103° F. during night.

March 6, 1926.—X-ray shows distinct improvement.

March 10, 1926.—Further manipulation under anæsthetic.

March 10, 1926.—X-ray shows better position of vertebra.

March 26, 1926.—Movements and general condition improved, Sent home with poroplastic collar.

January 1, 1927.—Epileptiform fits. None since.

Case of Splenomegaly for Diagnosis.

By KENNETH STONE, D.M.

E. H., AGED 11 years, boy.

History.—Admitted to East London Hospital for Children January 27, 1927, having had bouts of pain in the left hypochondrium, once or twice a week, for about two months. Pain is aching in character and does not radiate. Eighteen months ago jaundice, lasting eight or nine days. Occasional attacks of vomiting and diarrhœa since then.

Family History.—One of five children; the other four are healthy.

Examination on Admission.—Sub-icteric appearance of conjunctivæ. Trace of bile-pigment in the urine. No signs of disease in the chest. Some tenderness in the left hypochondrium. Spleen enlarged, extending almost to the mid-line, and downwards to just above the level of the umbilicus. Liver palpable just below the costal margin in the right nipple line.

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Blood.—Red blood-cells 4,950,000 per c.mm.; hæmoglobin 75 per cent.; colour index 0·7; white blood-cells 6,250 per c.mm.; polymorphonuclears, 58 per cent.: lymphocytes 27 per cent.; fragility normal; Wassermann negative.

Progress.—The trace of bile-pigment disappeared from the urine three days after admission. Patient has had no further abdominal pain nor any other symptom.

Van den Bergh test for blood bilirubin: direct, negative; indirect, faintly positive.

Von Pirquet reaction: positive.

Benzidin test for occult blood in the stools: positive in three successive specimens.

The case does not correspond closely with any of the commoner types of splenomegaly. Acholuric jaundice is scarcely a possibility, in view of the normal fragility of the red corpuscles, and there is no evidence pointing to chronic infection, such as tubercle or lymphadenoma. The possibility of splenic anæmia may be considered, in spite of the mild anæmia and the absence of symptoms. The enlargement of the spleen in a child with no disturbance of general health may suggest the Gaucher type of splenomegaly.

Discussion.—Dr. E. A. COCKAYNE said he thought this was a case of cirrhosis of the liver, as a very hard, irregular liver was palpable. It would be well to carry out tests for liver function, such as the galactose test.

Dr. F. PARKES WEBER said that in cases of chronic splenomegaly in children and young persons accompanied by temporary or persistent slight jaundice, if there seemed a likelihood that the condition was not hæmolytic jaundice, the most probable explanation was cirrhosis of the liver. But he agreed that the present case required further observation; tests of liver function could be made, and perhaps later on the blood-serum would be found to give a positive Hijmans van den Bergh reaction. In regard to this case, when he spoke of hepatic cirrhosis he meant the so-called *idiopathic* form, which he regarded as a special disease, and not very rare. It began in children or young adults without any of the recognized causes of cirrhosis of the liver. He supposed that the disease commenced—probably in the reticulo-endothelial tissue—either in the spleen or in the liver, or simultaneously in both these organs. If it commenced in the spleen the clinical picture was that of splenic anæmia or Banti's disease of the so-called adult type.[1] If it began in and was for some time apparently confined to the liver, the clinical picture would resemble that of hepatic cirrhosis, with later enlargement of the spleen. In most cases both organs were probably involved at the same time. Ultimately, however, in all cases signs of vascular obstruction in the portal circulation and partial biliary obstruction were likely to supervene, with recurrent hæmatemesis (which might itself be fatal), more or less jaundice, ascites, and cachexia.

If the spleen were excised in splenomegalic cases like the present one, and the patient survived the operation, he thought death was ultimately due to the progress of the liver disease. An important question was as to whether splenectomy in such cases ever hastened death apart from death directly due to the operation. If in the present case his diagnosis was correct, he thought splenectomy was not indicated.

Dr. W. M. FELDMAN said that if van den Bergh's test truly differentiated between obstructive and non-obstructive jaundice, the fact that it was of the indirect type in this case excluded the diagnosis of hepatic cirrhosis. Personally, he was not convinced that the test was absolutely diagnostic, because some time ago he published a case of congenital obliteration of the bile-duct in which, of course, there was absolute obstruction, and the van den Bergh reaction was of the indirect kind. Still, the general opinion was in favour of the diagnostic value of the test, therefore, in the present case, he (the speaker) did not see why the diagnosis of splenic anæmia should not stand. There was some bleeding, and the spleen was enlarged, and there was anæmia of the secondary type.

1 *Cf.* F. Parkes Weber, "The Nature of Banti's Disease and its Relation to Idiopathic Non-alcoholic Progressive Hepatic Cirrhosis in Children and Young Persons," *Brit. Journ. Child. Dis.*, London, 1923, xx, 78.

Dr. A. G. MAITLAND-JONES said he regarded this case as an example of splenomegalic cirrhosis of the liver. He would make the suggestion—arising out of Dr. Parkes Weber's remarks—that all cases of cirrhosis of the liver were idiopathic. Was there any evidence in this case of disease of the reticulo-endothelial system?

With regard to the van den Bergh test, he (the speaker) would prefer to rely on the clinical examination. At the London Hospital there had been a good deal of experience of the test, and he himself was not inclined to regard it as of much value.

Facial and Aural Congenital Mal-development in One of Twins.

By F. PARKES WEBER, M.D.

THE patient, S. C., is one of female twins, aged 3 weeks. Her twin sister is quite normal, but the patient herself has multiple congenital abnormalities of the face and ears. The nose has an external median groove separating the tip into two lobes. There is a median groove in the mucous margin of the upper lip and there is also a groove in the middle of the alveolar ridge of the upper jaw, suggesting the slightest degree of *median* hare-lip and (anterior) *median* cleft-palate. The palate is, however, not actually cleft and the uvula is not double or bifid. There seems to have been incomplete approximation in the middle line of the two fœtal nasal processes. In the right eye there is a deficiency in the inner portion of the free edge of the upper eyelid, the missing portion being apparently represented by a cutaneous polypoid excrescence attached to the sclerotic conjunctiva just internal to the cornea. The left external ear is altogether "crumpled up" and presents no external auditory opening; there are several soft (polypoid) "auricular appendages" in front of (ventral to) what represents the tragus. The right external ear is fairly normally developed, excepting that there are two or three soft "auricular appendages" in front of (ventral to) the tragus. No satisfactory information about the bony portion of the left ear has been obtained by X-ray examination. The accompanying illustration from a photograph, kindly taken by Dr. A. Stauss, shows the facial malformation fairly well.

In other respects the child seems normal. The blood-group to which both the twins belong is group 3 (group C). Whether the twins are really uni-ovular ("homologous," "identical") or not it is unfortunately now impossible to ascertain. The doctor who was present at their birth kindly tells me that they certainly had separate amniotic sacs, but had in common a single large placenta, into which both umbilical cords were inserted. The presence of congenital malformation in one twin and not in the other does not prove that they are not uni-ovular, for it is well known that congenital abnormality of development has occasionally been observed in one half of a person in whom the other half is normally developed. The foot-prints of these twins are not quite so like each other as might be expected.

The parents are Austrian Hebrews, aged 48 and 43 years respectively. Besides these twins they have had fourteen children (none of them twins), of whom ten are living. The patient seems to be the only one in the family with any congenital mal-development. There is no history of any "maternal impression." Amongst the relatives on the mother's side there is no history of twins or triplets, but in the father's family triplets are said to have occurred. It is now recognized that the tendency to twin-bearing may be due to the husband. The following illustration is known to me: two brothers in whose family twins were known to have occurred

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married two sisters of a family in which apparently twins had never occurred. Both these sisters gave birth to twins. (It was curious, however, that one of these pairs of twins showed partial colour-blindness, which was known to have occurred on the mother's and not on the father's side of the family.)

To show the facial mal-development.

Discussion.—Dr. W. M. FELDMAN asked whether this was a case of identical twins; if so, the interest was considerable. He did not think Dr. Parkes Weber had produced any evidence to show that this was a case of uni-ovular twins; the fact that they were enclosed in two sacs does not necessarily exclude uni-ovular origin if there was one common dividing partition between them consisting of no more than two layers, but in this case there was no information on this point, and therefore the evidence was by no means conclusive. An expert's opinion on the footprints would be of help.

Another point of interest was in connexion with the transmission of a tendency to "twinning" or multiple birth on the part of the father. It was a well-known phenomenon, and many cases of the kind were on record. Recently he had come across a record of a case in which husband and wife were each one of a set of triplets, and for the third time triplets were born to them. That showed that the capacity for producing triplets was hereditary, and that if it was present on both sides, the tendency was greatly accentuated.

Dr. L. G. PARSONS said he knew of an instance in which triplets were born, and the father had left his wife hurriedly after the occurrence and lived with another woman, who bore him twins.

Dr. KINGSTON BARTON said that Matthews Duncan, in his great work on sterility, had examined the birth question throughout Europe, and had arrived at the conclusion that twins or multiple births were a sign of what might be termed weakness of fecundity, even though there was an increased number of children; that if a woman married either too young or too old, it was very probable that her first conception would produce a multiple birth. That conclusion practically eliminated such points as the hereditary predisposition on the part of father or mother to give multiple births. Thirty-five years ago there was a view prevalent—which came from Paris—that all twins were syphilitic!

Dr. BERNARD MYERS said that two years ago he showed, at a meeting of this Section, a case of what the Members regarded as uni-ovular twins, one of whom only was a mongol.[1]

Dr. E. A. COCKAYNE said that Nettleship[2] had recorded a pair of uni-ovular twins, of which one was colour-blind and the other had normal vision. Other pairs had been described differing in the colour of the hair or eyes. Probably these were somatic mutations. The phenomenon was well known in plants and insects; in insects one half might show the characters of a Mendelian recessive, the other those of a dominant.[3] Similar cases occurred in man. Lettsom[4] had mentioned a girl with swarthy skin on one side of the body and long dark hair on one side of the head, and fair skin and short frizzled lighter hair on the other side. This was most likely due to somatic mutation, and if one side of a person's body could be affected in this way, no doubt one twin of a uni-ovular pair could be affected in the same way. [Dr. WEBER: Can there be uni-ocular colour-blindness?] Yes, it is possible.

Dr. PARKES WEBER showed diagrams from Professor Bumm's text-book to illustrate how difficult it might be, when there was only one placenta, to distinguish between uni-ovular and bi-ovular twins.

Case of Spastic Diplegia with Congenital Morbus Cordis.

By HAZEL CHODAK GREGORY, M.D.

FEMALE, aged 8 months, a twin. Born at full time ten minutes after first twin. Short labour, no difficulty. Weighed 3 lb. 9 oz.

Family History.—Father suffered from malaria and dysentery, otherwise healthy. Mother (aged 26), healthy during pregnancy, said to be "nervy and not very strong in the head." Twin under weight but normally developed with normal head. Maternal grandfather had fits and died in an asylum.

On Admission.—Wasting and vomiting; no convulsions; present weight between 7 and 8 lb.

Head small, deficient occiput (greatest circumference 14 in.), anterior fontanelle widely open. Child had all the appearances of mental deficiency, but has improved lately, sometimes smiles and takes notice. External strabismus of right eye.

Limbs very spastic with increased tendon reflexes; are rarely moved voluntarily. Spinal muscles also very rigid.

Heart—a loud systolic bruit heard over the whole præcordium and at the back.

The condition was noticed a month before I saw the child.

The case is shown in order to obtain an opinion as to the ætiology. Recent research and discussions have pointed to birth injury as a probable cause of infantile diplegias, and since the publication of Schwarz's statistics opinion has decidedly

1 *Proceedings*, 1925, xviii (Sect. Study Dis. Child.), 69.
2 Nettleship, *Trans. Ophth. Soc.*, 1912, xxxii, 311.
3 Cockayne, *Entomologist's Record*, 1922, xxxiv, 105, 200; 1924, xxxvi, 17.
4 Lettsom, *Mem. Med. Soc. Lond.* 1772, iii, 515.

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veered towards the theory that birth injury is the usual if not the only cause. In some cases, however, a primary mal-development of upper motor neurons seems probable, and this is a case in point where there is complete absence of difficulty at birth, a neuropathic family history, an associated congenital lesion, and a head which seems too small to be accounted for by a retardation of growth consequent on cerebral hæmorrhage.

Discussion.—Dr. NEILL HOBHOUSE agreed with Dr. Gregory in regarding the condition as pre-natal in origin.

Dr. L. G. PARSONS said that the smallness of the head and the easy delivery at birth were no proof that there was no damage, nor that subtentorial hæmorrhage could not occur. Many such hæmorrhages had occurred in premature children, even with rapid delivery. The presence of a congenital heart lesion here was some evidence that this was not a case of birth injury, although it was quite conceivable that a birth injury might occur in a child who also had congenital heart disease. The analysis of cases at the Johns Hopkins Hospital, published last year, strongly supported the theory that the condition was usually developmental and not a result of birth injury.

Section of Dermatology.

President—Dr. J. H. Sequeira.

Thallium.

By W. E. Dixon, M.D. (Cambridge).

My object in this communication is to give an explanation, as the result of experiments made under my supervision by Dr. J. H. Wadia, of the alopecia which thallium, however administered, produces in man and animals.

Thallium is a remarkable element, and chemists have not yet decided whether it should be regarded as an alkaline metal, like potassium and sodium—because of the solubility of its carbonates and hydrates, and the fact that it does not precipitate proteins—or whether it is more closely allied to lead. When a thallium salt is injected in moderate doses into animals or into human beings, it does not immediately produce any special objective action like lead, which, for example, may cause lead colic; it is only after some days that any obvious effect is apparent. Any immediate effect consists of a relaxation of plain muscle throughout the body, such as that of the bronchioles, the intestines and the uterus. But thallium has one remarkable action, which, as far as I am aware, is produced by no other metal: namely, that on the autonomic nervous system. It also exerts a small and relatively insignificant action on the medulla and the spinal cord. Certain substances such as strychnine allow reflexes to pass through the spinal cord more easily than usual, and so far as can be judged by these experiments thallium acts on the autonomic nervous system in much the same way. If the sympathetic nerve in the neck of a cat or rabbit is stimulated by a faradic current, dilatation of the pupil is produced, and erection of hairs and constriction of the ear vessels occur. If so weak a current is chosen that no obvious effects are produced and if the animal then receives a small dose of thallium, the same stimulation of the sympathetic produces a noticeable effect. This effect is not peculiar to the sympathetic in the neck, the principle applies to the whole autonomic system; normal stimuli are exaggerated under the influence of thallium.

The autonomic system is divided into two groups, the cranio-sacral and the sympathetic. The cranio-sacral nerves, such as those of the vagus to the intestines, bladder, etc., are affected in the same way as the sympathetic, though to a less degree. There are no other metals and few if any drugs which produce this exaggerated action of the autonomic system.

There is no other substance which acts like thallium in producing the characteristic alopecia in both men and animals.

All animals, with the possible exception of the guinea-pig, when injected with thallium, lose their hair; the hair at first becomes less glossy, it is easily rubbed off, and later is shed. The alopecia begins on the nape of the neck and round the ears, and the last hairs to fall are those round the chin and nose. But besides this action thallium, in small doses, stimulates the growth of the hair. In order to show this, two rabbits from the same litter were shaved on one or two areas; one animal was kept as a control and to the other thallium was administered.

78 Dixon: *Thallium*

In the first lantern slide shown the animal was shaved three weeks ago, and there is no apparent growth of hair in the shaved areas. The next slide shows an animal from the same litter, which after being shaved had received a dose of thallium, and in this case there is a distinct growth of new hair on the shaved parts. This is a characteristic result: the thallium, whilst destroying the old hair, promotes the growth of new hair. In the animal the only effect noticed is that the hair falls out, that is, there are no other definite objective effects. Sections of the alopecia area show an epidermis almost normal; in the dermis there is an increased density of fibrous tissue, but the sebaceous follicles are normal; the collection of epithelial cells is smaller than usual, but the dividing cells show nothing abnormal. Interruption in the normal growth of the hair is due to failure of the process of transition from the large polygonal cells to the stratified cells forming the hair.

With regard to the action of thallium on the autonomic system, the nerve cells on the course of the fibres are mainly affected. The resistance to impulses is largely determined by the nerve cell, and after painting these cells with thallium salts well diluted in saline solution the resistance is diminished.

As to the conclusion to be drawn from these experiments: There is a considerable evidence that nerve injury may produce alopecia and that mental shock which is closely associated with the autonomic system may have a similar effect; also there are many cases of trigeminal neuralgia resulting in alopecia over the area affected. On the other hand ordinary alopecia areata is often associated with neuralgia, itching and tenderness. Alopecia may then be associated with the nervous system in the patient.

With thallium there are two unusual and remarkable effects associated with one drug: the production of alopecia and a definite effect on the autonomic nervous system. And as alopecia areata is frequently associated with nervous phenomena, it may not unwarrantably be suggested that the autonomic system has a great part in its causation. Thallium rubbed into the skin does not depilate, nor does it locally affect the blood-vessels; it is only after absorption that this metal affects the hair.

Again, in post-mortem examinations of animals which have been treated with thallium the metal is found in almost every tissue of the body, and can easily be detected spectroscopically; the skin, however, retains less thallium than any other tissue. This is in marked contrast to arsenic, which is excreted by the skin, the skin always containing relatively large amounts.

Physicians often divide people into two groups: those possessing vagotonia in excess, and those who have excess of sympatheticotonia. The members of these groups respond differently to an appropriate stimulus: the pupils of the sympatheticotonics will dilate, the skin will flush, the heart will "race." In the case of the vagotonics the pupils will constrict, the skin will become pale and the heart will slow down. The Germans and the Anglo-Saxons are largely vagotonics, while the sympatheticotonics are found largely among Russians and some Latin races, especially in women. It is remarkable that the people who tend to become bald early are the people who have a diminution in their sympatheticotonic or an excess of their vagotonic function.

Discussion.—Dr. G. B. DOWLING asked whether the action of thallium, given in a single dose by the mouth, was immediate, or whether it was cumulative. In his own experience it had sometimes produced toxic symptoms in children, chiefly pains in the joints and occasionally headache, but these did not appear until about the tenth day, when the hair was beginning to loosen. The effect of the drug therefore seemed to him to be cumulative; being slowly excreted, it acted on the hair in much the same way as it produced its toxic effects. If that

were not so, perhaps a means would be found of cutting out the toxic action by administering some neutralizing agent if one could be found. Dr. Semon had suggested for this purpose the use of sodium thiosulphate. If this drug had such action several doses might be administered soon after giving thallium so as to ward off toxic manifestations. If, however, the action of the drug on the hair was cumulative, it would be necessary to put up with the toxic effects. At present it was difficult to say whether one was justified in treating ringworm in children with thallium rather than with X-rays; a larger series of cases might enable a decision on the point to be arrived at. So far, he had had about sixty cases, either treated or untreated, and until now nothing had happened to them which had any serious significance. A way out of the difficulty, if such arose, would be to give a sub-epilating dose of thallium, 6 mgm. per kilo of body weight, and a sub-epilating dose of X-rays. Possibly those two agents supplemented one another. He had treated three cases in this way; two were failures, the third was epilated very satisfactorily.

An interesting point in Professor Dixon's remarks was the question of the relation to alopecia areata. In the thallium alopecia one could easily see, in the early stage of regrowth, an enormous number of hairs which looked like exclamation-mark hairs, and if one pulled them they came out with the same slight tug that one experienced in pulling exclamation-mark hair. Professor Dixon's remarks suggested that the key to alopecia areata might be found in the action of thallium, as the sympathetic nervous system was definitely implicated in alopecia areata.

Dr. H. W. BARBER asked whether Professor Dixon, in his experiments, had found changes in the suprarenal glands. He (the speaker) believed that the German workers had reported degenerative lesions in these glands.

Dr. BENJAMIN asked whether the same proportional dose given to animals produced hair growth and epilation, or whether smaller doses were given to the shaved animals.

Dr. A. M. H. GRAY said that Buschke had described experiments in which he had combined X-rays with thallium. In some cases he had given 4 mgm. of thallium per kilo. and only one-third of a pastille dose of X-rays, and had obtained complete epilation.

Dr. F. PARKES WEBER asked what was the effect of different doses of thallium. Sometimes small doses of a drug stimulated, while large doses destroyed; for instance, small doses of benzol increased the number of red blood-corpuscles, while large doses diminished them. Perhaps in regard to thallium small doses might have the reverse effect of large doses.

Professor DIXON (in reply) said he thought the effect of thallium, like that of lead, was cumulative. It was excreted in the urine, but it did not injure the kidneys or cause albuminuria. Dr. Wadia, after several attempts, had failed to estimate the amount of thallium in the urine. If, after a succession of small doses of thallium had been given to an animal, the administration of the drug was stopped for the three following weeks, the metal exerted its effect in an even more pronounced degree than during its administration. The effect on the sympathetic nervous system might involve an effect on the suprarenals, as the sympathetic system was intimately connected with the endocrine glands. The action of the suprarenal glands should receive attention from dermatologists in some of these cases. A deficiency or an excess of adrenal secretion might be responsible for, or associated with, certain alopecias. If an animal was fed with thallium and then killed the adrenalin content of the suprarenal glands was found to be deficient.

The dose which when given to the shaved animals stimulated the growth of hair, was slightly less than the dose usually given to produce alopecia; but if an animal was shaved and thallium was afterwards administered every third day, the hair would be stimulated to grow in the shaved areas, while alopecia might occur on other parts of the body.

He believed that very large doses destroyed the hair follicles permanently, though animals had only been kept alive for six months after large areas of alopecia had appeared. Histological examination of the skin in these cases had, however, shown complete degeneration of the hair follicles.

In reply to Dr. Parkes Weber: small doses of thallium allowed the reflex to go through more easily; when toxic doses were reached the nerve ganglion cell became more resistant to stimuli. He did not think, however, that enough thallium could be given to depress seriously

the autonomic nerve-cells in life. It was not, however, depression which was the crucial factor concerned, because many drugs, like nicotine, caused depression of these cells, but there was only one known substance—thallium—which allowed the reflex to go through more easily.

Demonstration of the Detection of Ringworm Hairs on the Scalp by their Fluorescence under Ultra-violet Light.

By A. C. ROXBURGH, M.D.

(Method described by P. VIGNE, *Marseille Médicale*, November 15, 1926, 63.32, 1765. Abstract *Brit. Journ. of Actinotherapy*, January 1927, i, 24. "Appearances of Tinea Tonsurans under Ultra-violet Light," described by MARGAROT and DEVEZE in 1925.)

THE head is examined in a darkened room by the light from a mercury vapour or a tungsten arc lamp passed through a piece of Wood's glass, which is a dark violet glass containing oxide of nickel allowing only a very little red and visible violet and some long ultra-violet rays of wave-length from about 3,600 to 3,300 Ångstrom units to pass.

Normal hair and skin fluoresce only very slightly under this light, the finger nails rather more brightly, but ringworm-infected hairs fluoresce brilliantly with a greenish light. This enables one to identify very easily small groups of infected hairs or even single stumps on an otherwise healthy scalp. A stump broken off level with the skin will still fluoresce brightly in the mouth of its follicle, and hairs recently infected and not yet broken off fluoresce for the length which is infected only.

Apparently most scaly patches on the skin whether due to psoriasis or to seborrhœa fluoresce slightly though they do not shine so brightly as do the patches infected with ringworm. It is only when the hairs are infected that the appearance becomes pathognomonic. Cultures of ringworm fungi fluoresce only slightly.

A trace of vaseline on the scalp fluoresces brilliantly, and, even when this is cleaned off with ether, traces remain in the follicles, but it is still possible to distinguish ringworm stumps.

By the use of this method Vigne seems to have been able to stamp out ringworm in an orphanage in which it had been present for thirty years.

I have been using the method at St. Bartholomew's Hospital and in private practice for the last few weeks and have found it of the greatest value in ascertaining whether epilation after thallium acetate or X-rays is complete, or whether a few ringworm stumps still remain, also in deciding whether the brother or sister of a ringworm patient is already slightly infected or not.

The method is so easy to apply and so useful that it deserves to be more widely known in this country, especially now that mercury vapour lamps are generally employed in skin departments.

Wood's glass costs about 1s. 6d. per square inch, but only a small piece is required. A dark coloured piece should be used or two lighter pieces superimposed.

I am indebted to Professor F. L. Hopwood, of St. Bartholomew's Hospital, for the loan of the piece with which I experimented and for the use of his spectroscope.

Mr. T. Clark has kindly lent the mercury vapour lamp and has provided and fitted up the Wood's glass used in this demonstration.

Of the two patients shown, the larger patient was treated with thallium acetate a month ago, and all the normal hairs have fallen out, and are growing again. There are, however, many ringworm stumps remaining, and it seems possible that this very usual occurrence may interfere with the success of thallium in treating ringworm, because the new hair may be infected before the old has all gone.

The smaller patient received the dose of thallium only ten days ago, so that the hair has not as yet begun to fall out.

Discussion.—Dr. J. H. SEQUEIRA (President) said that this method should prove of great service in the early diagnosis of ringworm and also in the demonstration of cure, which was often far more difficult.

Dr. A. WHITFIELD asked whether Dr. Roxburgh had used the method on endothrix, a fungus which was not seen on the outside of the hair, and possibly might not fluoresce.

Dr. KNOWSLEY SIBLEY said he had found this method very useful for differential diagnosis. Recently he had had a patient, a girl, aged 12, whose hair was getting thin and breaking off. The pathologist's report after microscopical examination was "? large-spored ringworm," as he believed that he had discovered a fungus. The head was exposed to Wood's light and there was no fluorescence. More hairs were examined by the pathologist, who then reported that the condition was an early stage of trichorrhexis nodosa.

Another case was that of a boy, aged 10 years, with a large patch of complete alopecia of four years' duration in the tonsure region. The physician had never suspected ringworm; as to the naked-eye, the condition looked like a folliculitis decalvans. There was some superficial scarring and pustular inflammation of a few hair follicles at the periphery. The lamp showed baldness which was obscure, but in the hairs surrounding it fluorescence was evident, and when the hairs were turned back, though there was no epilation, the whole surrounding skin was seen to be infiltrated with ringworm fungus; this finding was confirmed by the microscope.

A great economy of time was effected by this method; at St. John's Skin Hospital, in from 1,500 to 2,000 cases each year microscopical examinations were made, and formerly every hair to be examined was stained. This procedure which involved from 10 to 15 minutes in making a diagnosis, and though more recently, clearing with liquor potassæ had usually been found satisfactory, the examination still occupied considerable time in the Pathological Laboratory. Now, however, it was only necessary to put the head under the light in order to see at once which, if any, areas were affected, and if after a dose of X-rays there was incomplete epilation, it could at once be seen whether there was any infected hairs remaining, and these could often be removed individually. That afternoon four boys had been brought to his (the speaker's) hospital, all with hair trouble. In three of the four the lamp showed ringworm areas, and the fourth boy had a complete tinea circinata on the forehead. It was the first case in which he (Dr. Sibley) had detected fluorescence of tinea on the skin; the ring on the forehead showed marked fluorescence, but there was no ringworm of the scalp.

Dr. J. E. M. WIGLEY asked if Dr. Roxburgh had had any experience of the efficacy of this method in cases of ringworm of the nails. As many of these case were notoriously difficult, both in diagnosis and in deciding when a cure had been obtained, any method which aided either would be very welcome.

Dr. ROXBURGH replied that he had not yet examined ringworm of the nails by this light. Normal nails fluoresced considerably, and nails affected by ringworm might perhaps fluoresce more than the normal nails did.

Section of Electro-Therapeutics.

President—Dr. G. B. BATTEN.

DISCUSSION ON CHOLECYSTOGRAPHY.

Dr. N. S. FINZI.

CHOLECYSTOGRAPHY is literally the radiography of the gall-bladder. Without some special method of demonstrating them, only a small proportion of gall-bladders are visible and those are usually diseased. In England also only a small proportion of gall-stones are opaque to X-rays. The gall-bladder may be made visible and gall-stones more visible by the inflation of the peritoneum with gas. In 1924 Graham and Cole, of St. Louis, working on the suggestion of Abel and Rowntree, introduced the method of demonstrating the gall-bladder by means of an opaque dye excreted into it and it is to this method that we usually refer when we talk of cholecystography, which we are here to discuss to-night.

The dyes used at the present time are tetra-iodophenolphthalein and its isomer phenol-tetra-iodophthalein. Tetrabrom-phenolphthalein is also used with the idea that it is less toxic; however, this is doubtful, and it is less opaque than the iodine compound.

In discussing the value of the method, let us consider first what it can do and therefore what are its limitations. In order to introduce the dye into the gall-bladder it must first obtain access to the blood either, with the aid of a surgeon, by means of intravenous injection, or, with the aid of a physician, through intra-oral administration. To prevent the dye leaving the gall-bladder it is necessary that the patient should not take food or drink subsequently to the administration of the dye until after the radiographic examination. If the dye enters the gall-bladder it may show:—

(1) Calculi (as clear spaces in the opaque dye).

(2) Irregularities in shape, size or position of the gall-bladder.

(3) Abnormal functioning of the gall-bladder as to concentrating the bile.

Failure of the dye to reach the gall-bladder may be due to the following facts:—

(1) That the cystic duct is obstructed. The cause of such obstruction may be: (*a*) adhesions; (*b*) gall-stones; (*c*) cholecystitis with swelling of the tissues of the duct or obstruction by a plug of mucus.

(2) That the liver fails to excrete the dye properly.

(3) That the patient has taken drink or even food.

(4) That, in cases of intra-oral administration, the dye has not been properly absorbed and has therefore not reached the blood.

Cholecystography will not be necessary in a proportion of cases of gall-bladder disease. When the clinical signs and symptoms are quite definite, it is unnecessary, and, being a severe proceeding, will not be used. Similarly, when a plain skiagram demonstrates opaque gall-stones, cholecystography will not be required. It is reserved therefore just for the doubtful and difficult cases.

If a gall-bladder fills and transparent calculi are seen in the opaque dye, the diagnosis is obvious. A few small calculi may, however, easily be invisible. As far as this is concerned it will not matter whether the administration is intravenous or oral. But when one depends on the failure of the gall-bladder to fill, in order to make a diagnosis of obstruction of the cystic duct, one must be quite certain that the dye has got into the blood. The failure of the liver to excrete the dye is occasionally

a factor of importance and some errors are due to this. The taking of a clandestine drink by the patient may vitiate the result and it might be well to explain the seriousness of this.

Therefore it seems we may expect a large percentage of correct diagnoses in cases of gall-bladder disease with stones, but when it comes to the milder degrees of cholecystitis with little change in the gall-bladder wall and no blocking of the cystic duct, it would not be surprising if the gall-bladder filled normally and showed nothing to indicate disease. This might even occur when the disease had progressed considerably, provided there were no adhesions to distort the shape of the gall-bladder. Failure to concentrate the bile, and therefore the dye, properly may result in the detection of cholecystitis.

The failure of the gall-bladder to fill is consequently a sign of the highest importance, if one knows that the dye has been absorbed, but the reverse—a normally-filling gall-bladder—does *not* necessarily exclude disease.

As the dye must be introduced into the blood, intravenous administration is the obvious method, if it can be shown to be without danger. On the other hand, the intra-oral method should act as well if the dye were always absorbed by the intestine. We have obtained better results at St. Bartholomew's Hospital with tetra-iodo-phenolphthalein than with tetrabrom-phenolphthalein.

Graham himself has now carried out 926 intravenous injections of the dye without serious mishap. Cade has performed over 300. At St. Bartholomew's Hospital we have only accurate records of thirty-six injections and the only serious symptoms we experienced was in some early cases in which the solution was allowed to stand some hours before use. This appears to be the secret, that the solution must be made up freshly. One death after intravenous injection has occurred in this country. I know there may be others. If so, I hope we shall hear details of such this evening. Graham shows, from his latest figures, which Dr. Sparks will give you (see pp. 60, 61), that reactions occur in fewer cases with phenol-tetra-iodophthalein than with tetra-iodophenolphthalein.

Against these figures with a percentage of correct results of 97·28 we have to place those from the Mayo Clinic. At that clinic Kirklin has examined over 3,000 cases in six months, all with tetrabrom-phenolphthalein and all by the oral method. Of these, 447 were operated upon. In diseased gall-bladder with stones the percentage of correct results was 94·98, or when personal errors, rather then error of method, were removed, 98·4. With severe gall-bladder disease the percentage of correct results falls to 79, and with slight changes in the gall-bladder to 66·6. Then comes an interesting point: In 111 cases in which a normal gall-bladder was diagnosed 24·4 per cent. were diseased. This is in accordance with the views I have already expressed as to the limitations of the method.

From the Mayo Clinic figures one would be inclined to suggest that the examination should first be oral and should be confirmed in doubtful cases by intravenous administration. I am sorry that my personal experience does not support this proposal, but with the bromine salt we often failed to get dense enough shadows and the oral administration has not always resulted in absorption of the dye from the bowel. If we can develop a technique as good as that of Kirklin seems to be, I might be persuaded to favour the oral method, but at present I am, however regrettable it may be, an advocate of the intravenous method with all the surgical technique involved. Our experience has been that one very rarely gets toxic effects with the intravenous method, but that they are common with the oral method.

Some English makers refuse to supply the drug on account of its supposed dangers. In so doing they appear to usurp a function which it is not theirs to exercise. It is for us to say whether a drug shall be used or not; that is not the work of the pharmacists. If they are not sufficiently skilful to make the chemical here, let them get it from America.

I believe all radiologists are agreed that in every case a preliminary skiagram should be taken before the administration of the dye, with the patient properly

prepared. The periodical examination is essential. With the intravenous method the patient must be examined at four hours, eight hours and twenty-four hours. The normal gall-bladder is fuller at the four-hour period, but the shadow is less dense than at the eight-hour period. If the shadow is larger at the eight-hour than the four-hour period it probably indicates cholecystitis, and this may be the means of removing some of the errors. With the oral method the examinations are made at twelve, eighteen and thirty-six hours.

As to technique, most of us use a Potter-Bucky diaphragm to take the skiagram, especially in the case of a stout patient, and a small diaphragm, even with this, improves matters. An anterior view is usually all that is required; a lateral view may help in some cases. Personally I have the patient lying on the back with an air cushion in the loins, the Potter-Bucky diaphragm is placed over the top of him and the tube below; but most people prefer to work the other way round. The barium examination of the stomach and duodenum sometimes helps as an accessory measure but, in the opinion of the majority, has not nearly the value of direct cholecystography.

The method has come to stay and it would not be surprising if the eventual drug were some such compound as tetra-iodophenol-tetra-iodophthalein.

(A number of slides of various conditions were then shown.)

Dr. J. F. Brailsford (Birmingham).

When Carmen and Counseller issued their preliminary report on cholecystography, Mr. A. W. Nuthall, Surgeon to the Queen's Hospital, kindly consented to try the test on a few patients, using the salt they advised, i.e. sodium tetrabrom-phenolphthalein, and he reported his operative findings in five cases early in 1925, to a meeting of the Birmingham Branch of the British Medical Association. Only five cases were reported on because one or two of the patients had very severe reactions which in his opinion did not justify the use of the test. At that meeting, however, he pointed out the importance of the paper just published by Whitaker and Millikin, who advised the use of sodium tetra-iodophenolphthalein instead of the bromine salt as only half of the weight of dye need then be injected. They showed that this very greatly reduced the possibility of reactions. The value of their work has now been universally recognized.

Technique.

The technique which I employ is as follows:—The patient is advised to take a mild aperient two days before submitting himself for the X-ray investigation. A mild aperient is used because after a violent purgative the colon is often filled with gas which may obscure delicate shadows. Light diet is advised until the X-ray examination. No dye is injected until preliminary X-ray investigation has been made of the thorax and abdomen.

Preliminary Investigation.

There is no more important part of the investigation than a preliminary radiographic examination of the thorax and abdomen; no alimentary radiographic examination can be considered complete which does not include this, though I admit that it is practically impossible to conduct it in the X-ray department of a busy hospital.

During the last two years I have made 317 alimentary investigations in which the preliminary radiographs have been made. They have shown gall-stones in twenty-seven cases, and gall-stones were shown in the preliminary radiographs in fifteen cases out of

thirty-one which were sent for confirmation of the diagnosis of "gall-stones." But in addition they have revealed lesions previously undiagnosed which would probably have been missed by the X-ray examination had no preliminary radiographs been taken. In some instances, where for one reason or another the barium meal was taken before the patient came for X-ray examination, important lesions had been missed which would have been detected. Most of us, during the radioscopic examination of a patient, have so concentrated our attention on searching for signs of the lesion suspected, that we have failed to see a perfectly obvious lesion, and this preliminary examination is valuable because it teaches us to examine the radiographs in detail without being prejudiced by the presence of barium into looking only for the lesion suspected. It is in the case with the indefinite symptoms that the physician or surgeon looks to us for help. Typical cases are not often sent for X-ray examination, though this examination may give additional helpful evidence, supporting, indicating or contra-indicating operative interference, and it is the experience of all that some cases with very typical signs and symptoms do not possess the lesion indicated.

Among the lesions previously unsuspected, which have been detected by the preliminary investigation are:—

(*a*) *In the thorax.*
- (1) Early phthisis with gastric symptoms.
- (2) Pulmonary tumour. Primary or multiple secondaries from abdominal organs. Hydatid cysts.
- (3) Aneurysm.

(*b*) *In the abdomen.*
- (1) Stone in the kidney or ureter.
- (2) Calcified tumour in the kidney.
- (3) Gall-stones.
- (4) Lesions of the spine causing abdominal pain. (Tubercle, gumma, neoplasm, Paget's disease.)
- (5) Abdominal aneurysm.

The subsequent histories showed that these were the lesions producing the symptoms complained of by the patients, and but for the preliminary radiographs would probably not have been diagnosed during the X-ray examination.

The preliminary radiographs are particularly important in cholecystography as they may show gall-stones, and then there is no need to inject the dye. But more important still are those cases in which the gall-bladder is filled with stone either formed or in the condition of sand, the radiographs of which are almost identical with the normal cholecystographs—the shadow is uniform in density and the outline is regular and pyriform. This is the type of case where normal filling may be reported, and at operation the gall-bladder may be found filled with stone. I have had two cases (for one case see Radiograph No. 1, fig. 1) in which this might easily have occurred.

The shadows cast by the gall-stones usually have something characteristic about them. The ring shadow is the one commonly described, but other forms occur which we all soon learn to recognize.

A large proportion of my cases have shown thin shadows of flaky, ill-defined, calcareous material which I consider as typical as the ring shadow. These can only be seen on radiographs which have been made of an absolutely still object. I have missed such shadows on some occasions even with half-second exposures, and have picked them up with radiographs taken with a flash exposure. While the Potter-Bucky diaphragm is generally very helpful if the patient remains absolutely still, flash exposures without it, on account of their increased rapidity eliminating the chances of movement, are sometimes more successful in demonstrating delicate shadows.

If the patient has a tremor it is almost essential to take flash radiographs, always using as soft a tube as possible. Thin shadows will be lost if a hard X-ray tube be used, or if the films are over-exposed, and not a few may be lost by faulty development. I have only been successful in demonstrating stones which are denser than the surrounding tissues, i.e., which contain calcium. I have never felt justified in diagnosing gall-stones from negative shadows on a preliminary radiograph. It is difficult to ascertain the percentage of gall-stones which can be shown on the preliminary radiographs, as they may vary in composition in different localities, and it is the common

FIG. 1 (Radiograph No. 1).—Shows a gall-bladder full of opaque sand which resembles the shadow of a normal gall-bladder filled with dye.

practice to operate without X-ray examination on patients who have typical signs and symptoms of gall-stones.

The percentage claimed to be shown by different observers varies from 1 to 50, or even more. This variation may be due to the difference in composition in different countries or localities or in the keenness of the observers. The figures of post-mortem findings vary in different localities. At the Queen's Hospital, Birmingham, out of 222 post-mortem examinations, gall-stones were found in only five cases.

48 Brailsford: *Cholecystography*

To quote Dr. Robert Knox's book on "Gall-bladder Radiology"—

"Too many of us in the past have been prone to approach the subject in a sceptical mood and perhaps even a negative one.

"It should be evident that the proper frame of mind to adopt is that it is possible to demonstrate the presence of gall-stones in a fairly large percentage of cases; perfunctory examination will then disappear and greater attention will be paid to the technique; the result will be gratifying in a number of cases."

Professor Haenisch (Hamburg), who has made a careful study of the subject, says that the percentage of correct X-ray diagnoses of gall-stones grows in proportion to the intensity of the interest, the more careful attention, the refinement of the technique, the study of the establishment of the diagnosis, the training of the eyes and the improvement which comes of constant use and experience with these opinions I am in full agreement.

IMPORTANCE OF GALL-STONE SHADOWS.

All gall-stones shown on preliminary radiographs contain calcium, and it is considered that these are usually associated with inflammation; their demonstration is, therefore, of great diagnostic value. In no case where gall-stones were shown has the patient not suffered from abdominal pain or discomfort.

One patient sent to me for an X-ray examination of the urinary tract, the left kidney being large and tender, gave no definite history of gall-stone colic, though the radiographs showed the gall-bladder to be full of calcium-containing stones. She was not operated upon because a large calculus occupied the pelvis and calyces of the right kidney, in addition to a stone in the pelvis of the enlarged and inflamed left kidney. A few weeks afterwards she had an acute attack of gall-stone colic, and these attacks were repeated so frequently during the next nine months that the patient was kept in bed. When they had ceased she improved in condition. By the end of the year she was able to do her housework. A further X-ray examination at this time showed that though the kidney stones appeared identical with the previous radiographs, only one small stone remained in the gall-bladder. A radiograph a month ago showed no gall-stones. She put on 3 or 4 st. in weight, had no pain and felt well.

In another case in which calcium gall-stones were shown on preliminary radiographs, a radiograph taken some months afterwards showed no gall-stones; the gall-bladder failed to fill with the dye, and at operation only a little grit was found in the chronically inflamed gall-bladder, the gall-stones having been passed.

The details of the following case also demonstrate that the signs and symptoms may be atypical.

The patient, who had had her right breast removed for carcinoma a few years ago, had an acute attack of agonizing pain in the left hypochondrium. The pain radiated through the left side of the thorax and down the left arm and lasted for twenty-four hours with great severity. The surgeon who had removed the breast was called in, but he could find no evidence of secondary growth, and suggested that the pain was due to hæmorrhage into a deep-seated secondary growth pressing upon nerves supplying the area. A radiograph was taken to demonstrate if possible the position and extent of the secondary deposits. The lung-fields were seen to be clear, and the heart and aorta normal in size, shape and position. The diaphragm moved normally on both sides. I suggested that the pain might be due to gall-stones, as I had recently seen several chest cases of gall-stone colic in which all the symptoms had been on the left side. A radiograph showed the gall-bladder to be full of calcium-containing gall-stones, and isolated stones were shown in a line suggesting that they were in the cystic duct.

Some authorities recommend the use of 10 in. by 8 in. duplitized films, which is quite a satisfactory size after the position of the gall-bladder has been demonstrated, but owing to the fact that the gall-bladder may be found in almost any position of the abdomen, radiographs should be taken to include the whole abdomen, films not

less than 15 in. by 12 in. being used for the preliminary radiographs. (See radiograph No. 2, fig. 2.)

It is advisable that the patient should wear a plain, warm, buttonless garment during the X-ray examination. Viyella, which can be obtained in many different colours, is a suitable material.

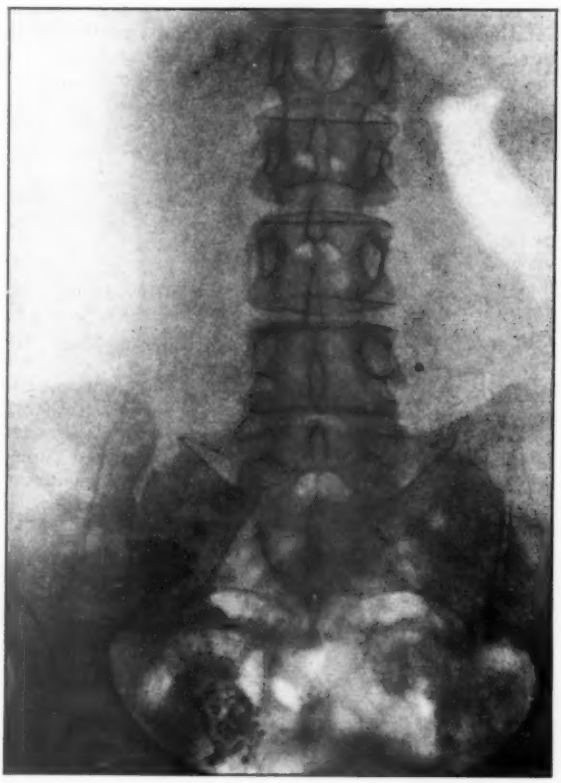

FIG. 2 (Radiograph No. 2).—Shows a collection of gall-stones on a plane with the sacrum (patient prone). Note calcifying fibroid below.

INJECTION OF THE DYE.

The dye used in these tests was sodium tetra-iodophenolphthalein. It is kept stored in a dark cupboard to prevent decomposition by sunlight, which is said to produce toxic products.

Three grams are dissolved in 40 c.c. distilled water, filtered and then sterilized in a cotton-wool plugged flask by heating it in a water bath at 212° F. for fifteen minutes. The solution is injected within an hour or so of being made.

With the patient lying in bed the arm is "cleaned-up" with spirit or ether, a tourniquet is applied to the arm and a syringe needle pushed into the median

basilic vein. As soon as blood spurts from the syringe needle, the tourniquet is released and the barrel of the syringe containing a small quantity of sterile saline solution is immediately connected by means of rubber tubing and suitable fittings to the needle; this readily flows into the vein. When most of it has passed, the dye is poured down the side of the syringe barrel, which is lowered so that the dye flows slowly into the vein, taking about ten to fifteen minutes. This is followed by a small quantity of sterile saline solution which clears the concentrated dye from the neighbourhood of the needle, which is then rapidly extracted and a plug of cotton-wool, moist with adrenalin solution, is applied and bandaged to the arm.

The best time for the injection is between 8 and 9 o'clock in the morning, when the patient is fasting, and the stomach is empty. The patient is advised to lie quiet in bed and try to sleep. The first radiographs are made from four to six hours after the injection, a second eight to ten hours, and a third twenty-four hours after injection. The intervals may be altered as the findings of the radiographs indicate. This timing is not the most suitable for hospital cases as the hour of the injection is not favoured by house-physicians, or surgeons, or ward sisters, and someone must attend during the afternoon for the eight hours' exposure. Notwithstanding these disadvantages, I am of opinion that the most accurate results are so obtained. Abnormal shadows shown at one hour can be checked against those shown at an earlier or later time and the contractility of the gall-bladder, its rate of filling and emptying can be determined.

Lately most of the injections at the Queen's Hospital have been made at night between 9 and 11 o'clock, the patient having had only a light tea. Only one radiograph is taken next day. This gives the parties concerned in the injection less inconvenience, but as the findings are not checked against other radiographs the accuracy suffers considerably. With our first cases the percentage of accurate diagnoses was 100, but with the use of the one-film method the percentage has fallen to nearly 90. Some German authorities (Pribram, Grünenberg and Strauss) recommend a preliminary injection of 2 c.c. pituitary extract with the object of beginning with an empty gall-bladder, as they suggest that the gall-bladderbile may not be changed or receive so little fresh dye-containing bile as to be invisible. They attribute the variation in the density of the shadows of normal gall-bladders in different individuals to the mixing of the dye with bile already present in the gall-bladder. This has not been carried out in any of the tests. Other authorities recommend that a meal should be given just before the injection for a like purpose.

To prevent reactions, other German workers have injected a preliminary dose of $\frac{1}{100}$ gr. atropine, which they say has enabled them to treat out-patients without any serious reactions. This procedure we have tried in a few cases, but as we have been fortunate without, we feel that we cannot give the atropine the credit. In no case, however, was the injection given to an out-patient.

Taking the Cholecystographs.

As with the preliminary radiographs the patient lies face-down on the Potter-Bucky diaphragm and an exposure of $\frac{1}{2}$ to $1\frac{1}{2}$ seconds is made, 15 in. by 12 in. duplisensitized films with intensifying screens being used, after the patient has been through a preliminary drill by being made to hold the breath. The film is then developed and any further exposures are determined by the results obtained. As a general rule it may be said that only one exposure is necessary. A correctly exposed and developed film is at once recognized, and provided no abnormal shadows are shown no benefit can be obtained by making further exposures with different degrees of softness of the tube. If, however, the radiograph is flat from over-exposure or from the use of too hard rays, it should be as readily recognized and a further attempt, or attempts, should be made to secure what most of us know to be the right quality of film.

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The outline of the normal gall-bladder on a correctly exposed film, with the patient quite still, is sharp, its borders are smooth and of a regular pyriform shape and its density uniform. For example, if you wish to photograph a building in a crowded thoroughfare, on giving an instantaneous exposure, all the moving objects are shown on the photograph quite sharply; if the exposure is lengthened, some of the moving objects will be travelling so fast or be so near the camera that no image is recorded, others will show a blurred image, while the very slow will be sharp; the exposure can be so lengthened by using a slow plate and stopping down the lens, so that

FIG. 3 (Cholecystograph No. 3).—Shows the gall-bladder filled with dye. It is abnormal in shape and appears to contain cholesterin stones.

the building is shown on a perfectly exposed negative, quite sharp, but with the thoroughfare apparently deserted. The same principle can be applied to gall-bladder radiography. When the patient and his organs are absolutely still the radiograph will show a sharp contour to all the structures, the degree of sharpness depending of course on the nearness to the film. If the gall-bladder has been moved by peristalsis in the bowel, or slight diaphragm movement, it may still be seen, but the shadow of any gall-stone within it, except the dense calcium-stones, will be absolutely lost; while if the movement of the gall-bladder during the exposure be sufficient, not

the slightest sign of it may be recorded in a perfectly exposed and developed film of good quality. I have made radiographs which have appeared satisfactory but on which the gall-bladder has not been shown, and further radiographs taken with flash exposures have shown a relatively dense shadow of the gall-bladder.

On the radiograph of the absolutely still object the gall-bladder shows distinctly, more, I think, on account of its sharpness of outline than on account of its relative density; because if the outline of the gall-bladder is encroached upon by shadows of intestinal contents, particularly if the patient has been taking any opaque material in

FIG. 4 (Cholecystograph No. 4).—Lateral radiograph of the same patient (see fig. 3), showing that the gall-bladder is normal in shape and uniform in density. The deformity was due to pressure from neighbouring structures; the negative "stones" being a collection of gas in the intestine.

medicine, or if its shadow has been divided by using too small a film, it is almost impossible to identify it, though you may pick up its outline quite distinctly after you have taken a further radiograph avoiding the features related.

Having obtained one radiograph showing the position of the gall-bladder, there is no need to use a large film, even 10 in. by 8 in. being quite suitable. If the radiograph shows any abnormality in the contour and position, or irregularity in the density of the gall-bladder, it is advisable to rotate the patient and attempt to separate the shadows or discover whether the deformity is persistent. The radiographs at the

different hours will be most helpful in confirming or dispelling the suggestion conveyed. (See Radiographs Nos. 3 and 4, figs. 3, 4.) If cholesterin stone be present in a gall-bladder which has filled in an apparently normal manner, it may not be shown when the gall-bladder is distended with dye, but later, when the gall-bladder has been partly emptied, it may show as a well-defined negative shadow. It has been stated by some German workers that the dye leaves a thin coating of opaque material on cholesterin or pigment stones so that their outline, which could not be seen

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIGS. 5, 6 (Radiographs Nos. 5 and 6).—Show gall-stones in excised gall-bladders in bile. These stones, with the exception of the one with the calcium nucleus, were not and could not be demonstrated on the preliminary radiographs.

FIGS. 7, 8 (Radiographs Nos. 7 and 8).—Show the same gall-stones and gall-bladders after the bile had been drained and substituted by a solution of sodium tetra-iodophenolphthalein of the strength used for injection.

before, can be shown after all the dye-containing bile has been emptied. With this I cannot agree, as I had one case in which no preliminary radiograph was taken and the first cholecystograph showed a definite calcium-containing stone and three cholesterin stones; the latter appeared as negative shadows.

This patient was operated upon the next day, the gall-bladder was excised and the bile still contained some dye. This bile was removed and replaced by some fresh bile and a radiograph of the gall-bladder with its stones was made.

(See Radiographs Nos. 6 and 8, figs. 6, 8.) It will be seen that there is no evidence of an external coat of opaque material; in fact it is almost impossible to make out the outline of the stones at all, even with the excised gall-bladder; so that it would be quite impossible with the gall-bladder *in situ*.

Some useful information can be obtained if a barium meal is given when the gall-bladder outline is well defined. In this way adhesions to the alimentary canal may be made out and other lesions detected which may not have been suspected. I would here state that in my opinion it is quite wrong to base one's advice solely on a cholecystograph which shows a normal-filled gall-bladder, and I suggest that in every case where a normal gall-bladder shadow is shown and the patient has symptoms of abdominal disease a barium meal investigation should be made. In one case in my series in which the gall-bladder filled normally it was decided that operative measures were not indicated, no barium meal investigation was made, the patient went home and returned a fortnight later with a perforated duodenal ulcer from which she died—the post-mortem examination revealed the ulcer with massive adhesions and a normal gall-bladder.

Even if the gall-bladder does not fill it is advisable to carry out a barium meal investigation as it may supply additional evidence of disease. In one of the cases in the series the gall-bladder did not fill and the barium meal revealed an ulcer deformity, while in two or three cases of non-filling, in which no barium meal was given, at operation ulcer of the duodenum was found and the gall-bladder appeared to be healthy. Is it possible that such a lesion may excite a more rapid and frequent emptying of the gall-bladder?

The importance of taking several radiographs at different angles is shown in the details of the following case:—

A preliminary radiograph showed a small rounded stone of uniform density of the size of a pea in the right hypochondrium. Radiographs were taken with films against the back of the abdomen and they showed that the shadow was larger with the film against the back, and, on this account, I suggested that it was a gall-stone. The patient being so stout and the shadow relatively faint it was impossible to get an impression of it with a lateral radiograph even when the patient was turned on to his side on the Potter-Bucky diaphragm, a procedure which may throw the shadow in front or behind the shadow of the spine and so defeat the purpose of the lateral radiograph. As some pus-cells were found in the urine a pyelograph was made and the shadow lay on the same plane as the pelvis of the kidney, the opaque contents of which obscured it. A slight rotation of the patient threw the shadows apart. A cholecystographic examination was made and the gall-bladder failed to fill with the dye. At operation the small stone was found in a chronically inflamed gall-bladder.

If no shadow of the gall-bladder is seen, further radiographs should be taken after an interval of about two hours, as it has been shown by various workers that the gall-bladder may be filled or empty at the sixteenth hour and empty or filled at the eighteenth to twentieth.

During the interval between the taking of the radiographs the patient should preferably lie quietly in bed. It is conceivable that external pressure over the gall-bladder area may cause it to empty. No food should be taken until a radiograph showing the gall-bladder has been made or until you have come to the decision that the gall-bladder will not fill.

Errors in the Diagnosis.

These may be due to: (1) the technique; (2) faults in the test.

The errors due to technique, apart from the selection, keeping and preparation of the dye solution, may occur at any stage.

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(1) *Injection of the Dye.*—It is very essential that this should be made with care, not only on account of local necrosis and thrombosis, but obviously because unless the dye does get into the blood-stream you will get no shadow. All of the injections made at hospital have been carried out by house-surgeons and physicians who have been very keen on trying the method, but it is easy to see how lack of interest might bring the method into disrepute. There is no doubt that the best results are obtained when the radiologist himself gives the injection, as he is personally responsible and knows exactly what has happened when the injection was given. In private practice I found that I was forced to do this as the physician or surgeon did not wish to do it or incur further expense.

(2) *Treatment of the Patient.*—Patients who are allowed to take food or exercise may, by so doing, empty the gall-bladder.

(3) *Radiography.*—The chief cause of error is movement, but an abnormally situated gall-bladder may be missed on a small film. A thin shadow may be lost by the use of a hard tube or by faulty screens or development.

(4) *Interpretation of the Cholecystographs.*—(*a*) The shadows of bubbles of gas in the intestine may be super-imposed on that of the gall-bladder and be interpreted as cholesterin stones. This may be avoided by checking the films against others taken at different hours or after rotation of the patient.

(*b*) The shadow of the gall-bladder may be deformed owing to external pressure in the prone position. Further radiographs should be taken with the patient rotated and while the gall-bladder is still visible. The relation of it to the duodenum, etc., may be determined by a barium meal.

(*c*) Cholesterin stone may be present in a normally filled gall-bladder and not be seen. If radiographs are taken at different hours such a stone may be seen after the dye is concentrated and the shadow small, but not in the distended gall-bladder.

(*d*) The gall-bladder may not have been filled at the time the radiograph was taken. Error on this account may be prevented by taking radiographs at four, eight, sixteen and twenty-four hours.

(*e*) The gall-bladder may be filled with opaque sand, which casts a shadow identical with the shadow cast by a normal gall-bladder after injection of sodium tetra-iodophenolphthalein, and unless a preliminary X-ray has been taken it may be interpreted as a normal gall-bladder. (See Radiographs No. 1 (fig. 1).)

(*f*) Stone in the gall-bladder may be mistaken for kidney stone. Kidney stone shadows are usually larger when the radiograph is made with the film on the abdomen than when the film is against the back. The opposite is the case with gall-stones. A cholecystograph or pyelograph will help, but it may be necessary to rotate the patient and attempt to separate the shadows.

(*g*) A few small stones (non-calcium) may be present in a gall-bladder which fills with the dye and not be indicated.

Reaction to the Dye.

The reactions seen in all but a small percentage of cases are almost negligible, providing that the patient is kept at rest in bed for an hour or two before the injection is made and until the radiographs are taken, and never more than 3 grm. of pure sodium tetra-iodophenolphthalein (made by a reliable firm) is injected, and that care be taken to see that the dye solution passes directly from the needle into the vein. The majority of the patients tell me that they have not noticed any effect, or if you ask them whether they feel better since the injection they will say that they do. About 10 per cent. will tell you that they had felt sick, had a headache or had vomited, but practically all these patients will state that they have had these "bilious attacks" before and, though no doubt brought on by the dye, they are quite prepared to consider the attack as a repetition of their former symptoms.

I have seen severe reactions occurring in two patients after nearly 200 injections of the iodine salt. Within a few minutes after the injection the patients showed all the signs of profound shock, rigors, marked pallor, sweating, subnormal temperature, rapid and shallow respiration, eyes and face indicating grave anxiety and exhaustion, cold clammy skin, pulse

very rapid and scarcely to be felt in all but the larger arteries, marked lowering of the blood-pressure, and complete muscular relaxation.

They were treated as cases of surgical shock and within an hour or so the attack ceased. These two patients had a faint tinge of jaundice which was thought to be of a toxic origin, but the source of the toxins could not be determined and the cholecystographic examination was made on account of the jaundice to exclude or inculpate the gall-bladder.

In one of these patients the jaundice obviously increased during the day after the injection had been made in the morning, and in the afternoon a very definite pigmentation could be seen.

This would indicate that patients considered to be suffering from a toxic hæmolytic jaundice are unfit for the injection of the dye, and at the same time it is highly probable that such a patient would not stand an anæsthetic and a laparotomy.

Several patients with obstructive jaundice, anginal pains, heart disease, or pancreatitis have been injected and no reaction has occurred. Age does not contra-indicate the injection—many of the patients were over 60 years of age.

One patient, who was susceptible to iodine, and had previously suffered from a dermatitis, developed an iodine rash after the injection.

One patient in the series had very small veins; there was difficulty in getting the needle into the vein, and some of the solution got into the tissues and a thrombosis of the basilic vein developed. A local necrosis occurred at the site of the injection in four or five cases where the dye was allowed to get into the tissues.

Graham and Cole in their original paper reported that the following toxic symptoms had accompanied the administration of the dye, 5·5 grm. of bromine salt, in some cases:—

(1) Vasomotor shock within five to ten minutes of varying intensity.
(2) Sensation of fullness and shortness of breath.
(3) Intestinal cramps and diarrhœa.
(4) Initial rise of blood-pressure of 10 to 15 mm.
(5) Nausea and vomiting.
(6) Perspiration.
(7) Rapid pulse.
(8) Headache.

Whitaker and Millikin, who first advised the use of the iodine salt, pointed out that this dye was as toxic as the bromine salt, but as, owing to its specific gravity, only half the quantity need be injected, the toxic effects could almost be abolished. Yet Professors Wilkin and Illingworth in their article in the *British Medical Journal*, December 5, 1926, in which they record their results, state:—

"In about a third of the cases the full dose of 5·5 grm. of the salt was administered, dissolved in 40 c.c. of water. In the remainder, three-quarters of this amount (4·125 grm.) was employed. The larger dose ensures a more definite shadow in the healthy case and appears to cause little or no more malaise than the smaller dose."

Only one fatal case has been recorded. Professor Graham, referring to the letter (*British Medical Journal*, November 6, 1926) giving details of this fatal case, says:—

"It has seemed to me advisable to call attention to the fact that not only was the dose given nearly twice as much as the dose which my associates and I have recommended in our publications, but that also certain precautions which we stated repeatedly as being desirable, if not necessary, were not taken in this case. Mr. Huddy states that the patient was given 5½ grm. of sodium tetra-iodophenolphthalein. The largest dose which we had given to a human being is 3½ grm., and we usually do not give more than 3 grm.

"For these reasons it would seem to me unfair to the method to have any reader conclude from the report of this case that the method, when properly carried out, is essentially one that is dangerous to life."

The test is, indeed, a valuable and a relatively accurate one, and it would be a great pity if it fell into disrepute from faulty technique.

Most writers on the subject say that the number of patients who show any severe reaction are small, but they will all welcome the discovery of a suitable drug which is absolutely non-toxic.

Other Methods of Administering the Dye.

Mercer and Robinson introduced the method of oral administration of the dye, and many workers in this and other countries have followed their example. I have only tried it in one case.

The patient vomited from time to time during the night and had diarrhœa the following morning. The radiograph taken the following morning did not show any shadow of the gall-bladder, and it was suggested that the dye should be injected into the vein to confirm this finding. The patient had been so ill after swallowing the dye that she refused the injection. On this account and upon the testimony of many other workers to the effect that a greater proportion of gastro-intestinal disturbances follow the oral method of administration the surgeons at the Queen's Hospital did not feel justified in using the method, as the injection method was so accurate and few reactions occurred.

There is no doubt that if the oral method were absolutely accurate it would be the most suitable, at any rate for hospital practice, but in view of the facts that the degree of absorption from the alimentary tract varies with the patient, and that operative interference is indicated by a non-filling of the gall-bladder, it is inferior to the injection.

The dye has also been given *per rectum* by Stegemann and others, but this method so far appears to be the least reliable.

Stewart, Einhorn, and others have given the dye by way of the duodenal tube, leaving the tube in position for about fifteen hours before injecting the dye. The injection of the dye even with 4 grm. doses gave rise to vomiting, diarrhœa and colic, and the gall-bladder shadows obtained were not so good as with the intravenous method.

At the Congress of German Radiologists held in April last year (1926), opinions were divided as to which was the best method, the intravenous or the oral. The balance of evidence was in favour of the dye being administered to the patient by the mouth, and it was suggested that if the gall-bladder did not fill this result should be checked by the intravenous method.

The Value of the Test.

The following is the summary of the cholecystographic and operative findings in the first 100 cholecystographic examinations after injecting the dye :—

Cholecystographic Report.	Operative Findings.		
(1) The gall-bladder filled in a normal manner (50 cases)	(*a*) Not operated upon ...	28	
	(*b*) Gall-bladder found to be normal in appearance	21	Ulcer of stomach or duodenum ... ... 8 Carcinoma ... ... 3 Appendix 10
	(*c*) Adhesions to gall-bladder—indicated by cholecystograph		1
(2) Faint or mottled filling of the gall-bladder (12 cases)	(*a*) Not operated upon		2
	(*b*) Gall-stones present		5
	(*c*) Cholecystitis		4
	(*d*) Gall-bladder adhesions		1
(3) No filling of the gall-bladder	(*a*) Not operated upon		7
	(*b*) Gall-stones present		26
	(*c*) Cholecystitis		3
	(*d*) Ulcer of duodenum		2
	(Gall-bladder looked healthy)		

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The second 100 cases show the following figures:—

Cholecystographic Report.		Operative Findings.	
(1) Normal filling (48 cases)	...	No operation	
(2) Faint fillings (6 cases)	...	(*a*) Gall-stones	2
		(*b*) Cholecystitis	2
		(*c*) Adhesions	2
(3) No filling (46 cases)	...	(*a*) No operation	20
		(*b*) Gall-stones	18
		(*c*) Cholecystitis	2
		(*d*) Gall-bladder appeared normal (No definite lesion found)	6

The chief differences in the figures given for the two sets of cases indicate that no patient with a normal gall-bladder filling was operated upon; this in itself shows that more confidence is placed in the test, and although no lesion was found in four cases (19 per cent.) in which the cholecystographs failed to show a gall-bladder shadow, in the first 100 cases the cholecystographic report was accurate in 97 per cent. In all these cases only one radiograph was made fourteen hours after the injection, which is hardly fair to the test. In no case where a series of radiographs was taken at different hours was the cholecystographic report in default.

The value of the test to the surgeon depends upon the care with which the examination is carried out. It may be argued that if the patient has symptoms of abdominal disease, particularly if it is apparently localized to one quadrant, the best method of investigation is laparotomy. But this may not be successful in revealing a pathological condition which would account for the symptoms and the gall-bladder may appear quite healthy. I suggest that in such a case the knowledge that the gall-bladder had failed to fill in a normal manner would be helpful to the surgeon.

I have indicated in this paper features which, left unconsidered, would have brought error into the cholecystographic report; there are no doubt other features which are equally important yet to be discovered by following the procedure from the injection of the patient to the operation. It is a test which is well worth doing, but like most tests it has its fallacies, which creep in at all stages unless all parties concerned are keen on the work. There is probably no branch of radiology which is so liable to error and which would bring the test into disrepute, if the examination is perfunctory: while, on the other hand, a careful worker will be rewarded by a very high percentage of accurate results and will bring the test into the position it deserves, i.e., the best test we have at present for diagnosing a pathological condition of the gall-bladder.

Dr. Bernard Schlesinger.

My purpose to-night is to emphasize the value of the oral method of cholecystography. Dr. Finzi has inquired for details of any disaster produced by the intravenous method of administration other than the cases he has quoted.

The first cholecystography at University College Hospital was attempted some fifteen months ago by the use of sodium tetrabrom-phenolphthalein salt, given into the vein. The immediate result was very alarming. Two minutes after the injection the patient became livid and unconscious and showed slight clonic movements of the arms and jaw lasting about one minute. Full consciousness was only regained after five minutes. In addition the radiogram of the gall-bladder was poor and the leaking of a few drops of the salt solution, outside the vein, produced a painful and troublesome cellulitis of the arm.

Following this unfortunate result the intravenous method has never been repeated at my hospital and steps were taken to try to perfect the oral method.

The technique carried out was roughly as follows:—

The powdered dye was placed in hard gelatin capsules, each containing 1 grm.

The capsules were then coated with stearic acid. The stearic acid must previously be liquefied by heating on a water bath at 80° C. One of the chief difficulties in using the oral method is to obtain a capsule so coated that it will readily pass undigested through the stomach but will break up easily in the intestines. Should this fail and the dye react with the hydrochloric acid in the stomach, nausea, vomiting or diarrhœa will result. Experimentally, it was found that a coating of stearic acid obtained by merely dipping the capsule into the liquid and instantly removing it, was too thick, for radiological examination showed whole capsules in the intestines unabsorbed. After repeated attempts the ideal and yet safe thickness of coating was obtained by securing the capsule on a pin, dipping into the liquid stearic acid and then spinning the capsule on the pin until the coating was dry. Other coatings were tried, especially the salol-covered "kerasol" capsules, but not with the same success.

(Slides reproduced from films were shown illustrating these points). In order to obtain some idea of the standard normal gall-bladder shadow as seen by the X-rays, sixteen healthy men and women from the hospital resident staff were subjected to the method. In these, as in all the cholecystographies that followed, the procedure and quantity of dye (6 grm.) administered were identical.

At 7.0 p.m. Dinner.
At 9.3 p.m. Two capsules, containing 1 grm. each, swallowed with half a pint of water.
At 9.15 p.m. Two more capsules with half a pint of water.
At 9.30 p.m. Two more capsules with a pint of water.
No more food or drink until after the second X-ray exposure on the following day.
At 9.30 am. First X-ray.
At 12 noon. Second X-ray, followed by a fatty meal—buttered eggs, milky tea, bread with plenty of butter.
At 3 p.m. Third X-ray.

On comparing all these control cases it was found that the shape, size and position of the gall-bladder showed great variation. The concentration of the dye, however, bore some relation to the time at which the radiogram was taken. Thus the shadow at fifteen hours, although smaller than that at twelve hours, was usually more intense, whereas after the fatty meal it was either very small or absent. Curiously enough in regard to the shape of the gall-bladder the tall, thin people tended to show long, narrow gall-bladder shadows, while the short, stout people appeared to possess short, round gall-bladders. This may have been, however, a mere coincidence.

In studying further the level of the normal gall-bladder in the prone position with the abdomen strapped well down to the X-ray table, forty cases of apparently normal cholecystograms were taken and the position of the gall-bladder in relation to the vertebræ noted as follows :—

Opposite lumbar vertebræ	...	2 and 3	...	25 cases	...	62 per cent.
,, ,, ,,	...	1 and 2	...	9 cases	...	23 per cent.
,, ,, ,,	...	3 and 4	...	6 cases	...	15 per cent.

Thus the position on a level with the second and third lumbar vertebræ is by far the commonest, although other situations are quite possible for normal gall-bladders.

The following X-ray picture was taken in the case of a patient suffering from general visceroptosis; it shows the gall-bladder well down in the pelvis on a level with the fourth and fifth lumbar vertebræ. The distance of the gall-bladder away from the vertebral column was also found not to be constant, although it was commonly found overlapped by the lateral spinous processes. Occasionally it may appear right away from the spinal column, and again, in one case, it was tucked away

medially so far in front of the vertebræ as to be almost obscured by them in the radiogram. Finally, the position of the colon is of some interest. It was found, as has already been noted by American workers, that almost invariably the gall-bladder lies above the colon and is, therefore, not obscured by any possible contents of the larger bowel. This fact is important in that it dispenses with the necessity of a prolonged purgative preparation for the radiogram.

With reference to the pathological cholecystograms, three radiographic abnormalities were found of constant value. These are (1) a non-filling of the dye; (2) a negative shadow in the midst of an opaque gall-bladder, and (3) an abnormal position of the gall-bladder in relation to the twelfth rib. In the first instance direct proof was available in three cases at operation, and the presence of calculi and cholecystitis confirmed. Four other cases showing non-filling of the gall-bladder with dye were, clinically, typical cases of cholecystitis and cholelithiasis with rigors, tenderness in the right hypochondrium, pains in the shoulder, jaundice in three cases, and a palpable tender gall-bladder in one.

Negative shadows were seen in two cholecystograms, and in each case stones were removed by operation and very little accompanying cholecystitis was found. This fact would account for the gall-bladder filling at all in the presence of calculi.

The third abnormality referred to, namely, the discovery of a gall-bladder shadow tucked away under the twelfth rib and lying parallel to it, is a radiological appearance seldom described. Yet it is of distinct significance, and on the three occasions in which it occurred in one series, cholecystitis with or without cholelithiasis was found at operation.

Summing up then those cases which were proved at operation we have:—

X-ray findings	Cases	Operation findings	Cases
(1) Non-filling with dye	3	Cholelithiasis and cholecystitis	3
(2) Negative shadows...	2	Cholelithiasis	2
(3) Abnormal position of gall-bladder lying under eleventh and twelfth rib ...	3	Cholelithiasis and cholecystitis	2
		Chronic cholecystitis	1

In contrast to this, in one case, which appeared clinically as a case of cholecystitis, but which presented a normal cholecystography, the patient was operated upon, and was found to have a gastric ulcer and a normal gall-bladder.

The above description would not be complete or fair if mention were not made of conditions outside the gall-bladder but involving the biliary tract, which cause chronic jaundice and result in a non-filling of the gall-bladder in cholecystography. One such case came under our notice giving a negative radiographic result and proving at autopsy to be carcinoma at the head of the pancreas.

From this account of some fifty-five cases—undoubtedly a small number—it is yet possible to infer that the oral method of administration of the dye by the technique described is in most cases of considerable value. As the source of the dye became more reliable, the number of occasions on which nausea or diarrhœa was complained of diminished, until now this is almost a matter of the past. Only to-day, a patient, wrongly interpreting the test as one of therapeutic rather than of diagnostic value, thanked me for the pills "which had relieved all her pain," and requested me to give her some to take home should the pain return. Were one to compare the case of this last-mentioned patient with our first disastrous intravenous result, which I have already described, there would be no hesitation as to which should be counted the best method. (Slides were also shown illustrating the vicissitudes of normal gall-bladdershadows and others demonstrating the points in the pathological cases which have been raised.)

Dr. J. V. SPARKS

showed figures illustrating the results obtained at the Mayo Clinic at Rochester U.S.A., which had been given him by Dr. B. R. Kirklin during his recent visit to America.

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He pointed out that these were verified results of 3,357 cholecystographic examinations done between May and December, 1926.

Tetrabromo-phenolphthalein was administered by the oral method.

TABLE I.

Findings at operation	No.	X-ray diagnosis of cholecystic disease	X-ray negative	X-ray correct percentage
Diseased gall-bladder with stones	219	208	11	94·98
Marked disease of gall-bladder without stones	105	81	24	77·14
Slight cholecystitis without stones	15	8	7	46·66
Normal gall-bladder at exploration	108	36	72	66·65

TABLE II.

Röntgen signs	No.	Diseased gall-bladder with stones	Diseased gall-bladder	Slight cholecystitis	Normal gall-bladder	Correct percentage
Gall-bladder invisible ...	214	146	46	6	16	92·51
Faint shadow gall-bladder	119	62	35	2	20	83·19
Stone shadows	63	60	1	1	1	95·25
Negative (normal) ...	114	11	24	7	72	63·15

He pointed out the reliability of the invisible "non-filling" gall-bladder in the analysis and said that a percentage of correctness of 92·51 was a very remarkable one and emphasized how perfect the technique must be to have obtained such results.

The greatest source of error was in the cases reported as filling normally, and this percentage was not likely to be improved by employing the intravenous method of administration.

Dr. L. A. ROWDEN

said he had only used the oral method in private practice. At first, when the directions on the bottle (kerasol) were carefully adhered to, he had had considerable trouble owing to the occurrence of toxic symptoms. Since he had adopted the plan of giving the dye—beginning a quarter of an hour after an ordinary full meal, when the stomach was rapidly emptying, these untoward symptoms had been absent.

He had examined a large number of gall-bladders immediately after operation, and had found that fully 50 per cent. could not have given a shadow. The absence of a shadow, therefore, was a most important diagnostic sign, provided a worker could be sure of his technique.

Dr. F. HERNAMAN-JOHNSON

said he wished to put in a plea for giving the dye, first as a routine, and doing an "ordinary" radiograph some days later. The reason was that, owing to the extremely variable position of the gall-bladder, and its tendency to be partially hidden by the ribs and spine at certain phases of respiration, it was impossible to be sure that a gall-stone shadow, even if present, would be recognized unless the approximate position of the viscus were known. But by noting the exact position of the gall-bladder under definite conditions, this region could be particularly studied after the dye had disappeared.

The administration of a fatty meal in order to provoke contracture of the gall-bladder appeared to him of great importance. When a normally filled gall-bladder contracted to half or less than half under such stimulus, the possibility of it being seriously diseased was remote.

Mr. STANFORD CADE

said that his experience of cholecystography consisted of 340 cases, of which over a hundred had ultimately been operated upon and the X-ray findings confirmed. He invariably used the intravenous method, which he found quite safe if the usual

preparation of the patient was carried out and the drug freshly prepared. The advantages of the intravenous method over the oral were numerous. If no shadow was obtained after an intravenous injection, disease of the biliary tract was present. Absence of a shadow after oral administration was of no diagnostic value. Oral administration never gave as good results as the intravenous method. It yielded also far less information as regarded function of the gall-bladder, as the shadow appeared much later, lasted a shorter period, and the density was not so marked.

In connexion with the fatal case published by Mr. Huddy, it was important to realize that since Graham had first described his method many thousand cholecystographies had been done, and in the fatal case recorded a much bigger dose than was necessary to obtain a shadow was given.

The safety of the method depended upon the following data :—

Certain salts were toxic and should not be employed. The drug provided must be freshly prepared, injected warm, and the dose should never exceed 4 grm. Sodium tetra-iodophenolphthalein when oxidized became very toxic.

Experimentally, it was found the doses up to 0·2 grm. per kilo body weight produced no toxic effects. A large overdose was followed by an immediate fall of blood-pressure, and dogs had died within twenty-five minutes of an injection. With a smaller overdose, dogs had survived six, ten, fifteen hours, and in these post-mortem examination had revealed intense congestion of the intralobular veins of the liver, marked subcapsular hæmorrhage and areas of necrosis of the liver-tissue.

Mr. J. P. Ross.

(From the Surgical Professorial Unit, St. Bartholomew's Hospital.)

Cholecystography has been employed in the Surgical Professorial Unit at St. Bartholomew's Hospital as a diagnostic method in certain cases of suspected gall-bladder disease during the past 18 months.

Since all the publications contained accounts of the toxic properties of the various bodies used for outlining the gall-bladder, especially when administered intravenously, it was considered wise to use tetrabrom-phenolphthalein by the mouth, and this salt was given to the first five of our patients. The results obtained were inconclusive and unsatisfactory, in that they did not give us any further help in deciding upon the correct treatment of the patients.

We determined, therefore, to try the intravenous administration of sodium tetra-iodophenolphthalein, obtaining the drug in solution in sealed glass ampoules. The risks in intravenous injection are local and general, the local being those of thrombosis of the vein, or of sloughing of the tissues if even a small drop of the dye escapes outside the vein; the general being those of dizziness, faintness, nausea and vomiting, and in severe cases pallor, sweating, great fall of blood-pressure and unconsciousness. The local risks were avoided by careful technique in injecting the dye, but in our first five cases we experienced two slight and three very severe general reactions. Two of the patients became very collapsed and were unconscious for an hour or more after the injection had been given.

It was decided that it would be unjustifiable to give any more injections until the cause of these reactions could be found and eliminated, and in order to discover the cause certain animal experiments were undertaken. We found that while some samples of the dye were harmless others were extremely toxic; also that the toxic effects became manifest when a tiny dose had been given (i.e., right at the beginning of the injection), and that if the toxic drug were given in a large number of small doses at intervals of a few minutes the toxic effects became less and less marked as the administration proceeded, some form of immunity seeming to be established. The total dose given intermittently must have proved fatal if administered at

one time. Our impressions were that the reactions were due to the chemical composition of the dye and not to our method of administering it; that the dye tended to become more toxic on its being kept in solution; and that the colour of the solution might give some indication of its toxicity, the pure dye being of a deep blue colour and the toxic solutions having a purple or even reddish-blue tint.

We therefore obtained the dye from another chemist; the solutions we have injected have been freshly prepared, and we have had no further trouble. Thirty-one injections have now been given without any reaction whatever—the patients simply lie quietly in bed and experience no peculiar sensation, nor is there any change in the pulse-rate or blood-pressure. We give a smaller dose now than we used to give, but that is of comparatively minor importance since a toxic drug produces symptoms as soon as the first few c.c. have been run in.

If the dye is toxic the bad effects are likely to be most marked in persons who have some disease of the liver which prevents excretion of the dye. Recently an intravenous injection of 3·5 grm. of sodium tetra-iodophenolphthalein was given to a patient with very advanced cirrhosis of the liver. Although the dye was not excreted in sufficient quantity to produce a shadow in the skiagram yet the patient showed no toxic reaction. This may be taken to show the harmless nature of the dye we are using at present, provided it is administered with proper care.

We have varied our method several times and it will probably be altered again, yet it may be of value to give an account of our present routine.

The day before the injection is to be given a skiagram of the gall-bladder region is taken after the usual "preparation" of the patient. This skiagram may show gall-stones—thus rendering the injection unnecessary—and will show any abnormal shadow in this area which might later be mistaken for the shadow of dye in the gall-bladder. For the rest of the day only light food is given, so that further purging and "preparation" of the patient will not be necessary before the cholecystograms are taken.

On the morning of the injection, at 6 o'clock, the patient is given a meal consisting of a boiled egg, two pieces of thin bread thickly spread with butter, and a cup of creamy milk. After that no food is allowed till 6 p.m. At 9.30 a.m. the dye is injected, and skiagrams are taken at 1.30 p.m. and again at 5.30 p.m., that is, four hours and eight hours after the injection. No food or medicine of any kind is taken till after the eight hours' skiagram, but at 6 p.m. the patient is given the usual supper and the normal routine is resumed. Next morning, at 9.30, a third X-ray picture is taken. A "normal" gall-bladder shows a good shadow at four hours, which is smaller and denser at eight hours, and has disappeared at twenty-four hours when food has been taken.

The dose we give varies from 3 to 3·5 grm. of sodium tetra-iodophenolphthalein, according to the patient's weight. The needle, to which about 4 in. of rubber tubing is attached, is first introduced into the vein. When blood runs from the tube a syringe filled with normal saline solution is attached and the saline run in in order to make sure that the needle is well in the lumen of the vein and that none of the solution is escaping. The syringe is now replaced by the dye-containing syringe and the dye is injected very slowly. After 5 c.c. have been injected we pause for a minute, and if no reaction is noticed the injection is continued, fifteen minutes being the time taken to inject 35 c.c. of the 10 per cent. solution of dye. The syringe is then replaced by the one containing saline, and about 10 c.c. of saline are run in to wash out all traces of dye from the needle and tube. If this step is neglected the risk of thrombosis of the vein is much increased.

In our early experiences of cholecystography the patients became very faint. We have since made it a rule to keep the patients flat in bed (one low pillow only under the head) during and for a short time after the injection. It is probable, however, that this precaution is not really essential. We used to give large doses of sodium bicarbonate during a forty-eight hour period, twelve hours before and thirty-six hours after the injection, but we have abandoned this practice. It does

not appear to help in giving a better picture, and it usually makes the patients feel sick.

The results obtained with cholecystography by the intravenous method at St. Bartholomew's Hospital may be tabulated as follows :—

(1) Total number of intravenous injections, thirty-six.
(2) Cases to be excluded (early ones in which improper dye was used), five.
(3) Number of cases subsequently operated upon, twenty-three.

Of these twenty-three cases, five gave a normal cholecystogram and at operation showed a normal gall-bladder. Eighteen gave a cholecystogram indicating a pathological gall-bladder, and of these sixteen were proved by operation to be correct. [One of the patients whose condition had been incorrectly diagnosed had been given an aperient before the X-ray picture was taken, so that it would be more correct to say that seventeen gave abnormal X-ray pictures, and sixteen were proved by operation to be pathological.]

When the oral method of administering the dye is employed it is often difficult to know the amount of the dye entering the blood-stream and arriving at the liver. If the capsules break up in the stomach the dye cannot be absorbed, and the patient suffers from nausea and vomiting. If the capsules do not break up in the jejunum they may pass on and be seen radiographically in the lower parts of the alimentary canal. It is essential, if the oral method be used, to screen the whole abdomen in order to look for unabsorbed dye before the gall-bladder region is reported on. If no dye is seen in the intestine it is to be presumed that it has reached the liver, but under any circumstances the absence of a shadow in the gall-bladder cannot be regarded at present as a certain sign of hepatic or biliary disease when the dye is given by the mouth. This is a serious drawback as compared with the intravenous method, in which the absence of a shadow means a very great deal. The report on the density of the shadow (indicative of cholecystitis) must also be unreliable if it is not certain that all the dye has been absorbed.

The results of the oral method for cholecystography at St. Bartholomew's Hospital are shown in the following table. Tetra-iodophenolphthalein has been used in all except the first six cases.

(1) Total number of oral administrations, thirty-seven.
(2) Number of cases subsequently operated upon, twenty-four.
(3) Of these twenty-four cases two gave a normal cholecystogram, and at operation showed a normal gall-bladder. Twenty-two gave cholecystograms indicating a pathological condition of the gall-bladder. Of these seventeen were proved by operation to be pathological, but five were normal.

INTRAVENOUS.

Cases		31
Operations		23
Cholecystogram, pathological		18
Operation	pathological	16
	normal	2

ORAL.

Cases		37
Operations		24
Cholecystogram, pathological		22
Operation	pathological	17
	normal	5

Cholecystography is of help not only in the diagnosis of obstruction in the biliary system, and of cholecystitis, but has also proved useful in diagnosis of conditions outside the bile passages.

Two of our cases are good examples of this. One man who had a swelling with all the clinical characters of an enlarged gall-bladder (calculous cholecystitis with obstruction to the cystic duct) gave a cholecystogram in which the gall-bladder filled but was displaced

upwards. The swelling was found to be a twisted portion of the great omentum. In another case shadows in the gall-bladder region which might have been taken for gall-stones were proved by cholecystography to be outside the gall-bladder. At operation the lesion was found to be in the head of the pancreas.

In our experience cholecystography is not of value in the examination of jaundiced patients, though we have not found that these patients suffer as a result of the investigation.

In conclusion it may be said that at present the intravenous method in our hands has been found more reliable than the oral method. Dr. Finzi has hinted that the intravenous injection is as serious an affair as a surgical operation. To anyone who is familiar with the technique of intravenous injection it is not a formidable undertaking, and provided that the drug is pure and the dye is run slowly into the vein the intravenous should be as safe as the oral method, and much more reliable.

Dr. W. H. Coldwell.

It does not appear to be essential for patients to refrain from all food and drink during the examination. Eating some biscuits and drinking a cup of tea does not appear to have any effect on the gall-bladder, and is much appreciated by the patients after the first examination at the end of four hours.

One cause of failure to obtain a shadow that has not been mentioned is malignant disease of the gall-bladder itself or a mass of glands in the portal fissure, causing pressure on the duct.

The oral method is at present so uncertain in its percentage of absorption that any approach to some standard type of normal shadow is difficult or impossible.

Note should be made of the possible presence of the drug in the colon after excretion by the gall-bladder, and care should be taken to distinguish this from the presence of undissolved salt in the colon if the oral method is used. Toxic symptoms appear to be more severe under the use of the oral method than under that of the intravenous as long as the preparation for the latter is carefully carried out. Patients in whose case both methods have been carried out say that they prefer the intravenous.

Too much attention seems to have been paid to the question of gall-stones, as after all they are only one indication of the presence of a pathological condition in the gall-bladder and non-calculous diseases can set up quite as severe conditions.

Future work should tend to correlate the results of cholecystography with those of the chemical examination of the blood for cholesterol and bilirubin and of the urine for urea and nitrogen.

Dr. Finzi (in reply)

said that, on the whole, the meeting seemed to be in favour of the intravenous method. He had tried to provoke an enumeration of bad results as the result of this method, but had failed to elucidate any very serious cases, at any rate there appeared to have been only the one death and all the serious cases seemed to have been due to the use of improper material.

He was not in favour of the radiologist injecting the dye himself. Most radiologists had no or little practical experience in intravenous injections, and with very few exceptions he thought they would prefer to leave that to the surgeon.

The question of the opacity of American gall-stones puzzled him considerably. He believed they must be of different composition because most of the gall-stones shown by American radiologists were obviously calcium-containing stones and these were only very rarely seen in this country. One skiagram which he had thrown on the screen showed how easy it was to demonstrate these calcified gall-stones and

to produce an excellent radiogram. But when the gall-stone was of a transparent substance which was of the same density as the surrounding tissues it was not possible for any radiologist to show it with whatever apparatus he liked and with the most perfect technique. In this country he found that the vast majority of gall-stones were of this transparent nature, so much so that occasionally they could be shown as clear spaces in a slightly opaque thickened gall-bladder.

As to obtaining a normal shadow with a pathological gall-bladder, a great deal depended on the surgeon. It was the same as with the appendix: some surgeons regarded almost every gall-bladder as pathological, but others admitted that a few were normal.

At St. Bartholomew's Hospital they had given up the use of sodium bicarbonate because it was found that when it was administered nausea resulted.

He (Dr. Finzi) did not believe that one could get a standard depth of shadow because this depended on the excretion of the dye by the liver, which had been known to vary in different normal people.

He quite agreed that all patients should have the duodenum examined by an opaque meal.

Section of Medicine.

President—Dr. Hugh Thursfield.

Stenosis (Co-arctation) of the Aortic Isthmus, with Sudden Death from Rupture of a Cerebral Aneurysm.

By F. Parkes Weber, M.D.

The patient, S. P., aged 40, English, was admitted to the German Hospital, Dalston, on December 2, 1926, with the history that in connexion with straining at stool he had had, on November 30, a sudden cerebral "attack" of some kind, probably without real loss of consciousness, at all events for not more than ten minutes. This attack was said to have been followed by symptoms (weakness?) on the left side of the body, which, however, had disappeared before his admission to the hospital, two days later.

In the hospital he was found to have decided enlargement of the heart to the left, with a double aortic murmur, and a sudden, relapsing pulse ("Corrigan's water-hammer pulse") at the wrist, typical of aortic regurgitation. There was likewise cutaneous "capillary pulsation" on the forehead. Ordinary examination of the lungs and abdomen showed nothing abnormal. The brachial blood-pressure (estimated, I think, in one arm only) was systolic, 200 mm. Hg; diastolic, 85 mm. Hg. The urine contained a trace of albumin; no sugar; no excess of urobilinogen; the centrifuge sediment contained some white blood-cells and a few erythrocytes, but no tube-casts were seen. A test of the renal function (by concentration and dilution of the urine) gave normal figures. There was no fever; the pulse was 72 to 88 per minute, and the respiration was 20 to 24 per minute. The pupils appeared normal and reacted normally. The patellar reflexes were both active, equal on the two sides. No Babinski's sign was obtained on either side. Ophthalmoscopic examination (by Dr. C. Markus, December 6) showed normal fundi, though the appearance on the two sides was not quite similar; there was a fovea centralis in the right, but not in the left, optic papilla. The blood-serum (December 8) gave negative Wassermann and Meinicke reactions.

There was nothing special in the family history. The patient was married and had had two children; both of them were living; his wife had had no miscarriages. He had been moderate in regard to alcohol and tobacco. At 20 years of age he had had scarlet fever, and seven years ago (at 33 years of age) he had had a kind of "rheumatism," but was not laid up with it. His work was that of milkman, distributing milk in the neighbourhood of the hospital, and though this occupation

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was fairly strenuous, he seemed not to have found it too much for him. He appeared well-grown.

Apart from the cerebral attack, which had passed off, I should have regarded the case as a typical one of aortic regurgitation, were it not that there were two enlarged superficial (subcutaneous) arteries on the front of the chest, in which pulsation could be easily felt by digital palpation. They were situated symmetrically, about two finger-breadths below the sterno-clavicular joints, one on each side of the sternum, extending from close to the sternum outwards (transversely to the body-length) till they were lost at about the nipple line on either side. Though this pair of enlarged subcutaneous arteries were not dissected out at the subsequent post-mortem examination, they were evidently the superficial external divisions—greatly dilated—of "perforating" branches (i.e., perforating through the first intercostal spaces) of the enormously enlarged internal mammary arteries. Their presence made me immediately think of the possibility of the patient having the so-called adult type of stenosis (co-arctation) of the aortic isthmus. On two previous occasions I had been able to correctly diagnose this condition because I could feel, especially on the back of the thorax, the superficial pulsating arteries which helped to carry on the collateral arterial circulation. In the present patient, however, by careful palpation over his back and elsewhere, I could feel no other pulsating arteries of the kind, and was therefore uncertain whether we had not to do with a peculiar congenital abnormality of the two vessels in question (though probably no such congenital abnormality has ever been met with) in a patient with aortic regurgitation; the cause of the aortic regurgitation remained uncertain, as there was no history of acute rheumatism and no evidence of syphilis.

Roentgen examination of the thorax (December 6) merely confirmed the absence of thoracic aneurysm and the presence of enlargement of the heart to the left, and showed nothing else pointing to isthmus-stenosis. Nevertheless, the clinical diagnosis of stenosis (co-arctation) of the aortic isthmus might have been made with certainty, but to this subject I shall return further on.

On December 13, not long before he was to have left the hospital, the patient died very suddenly at 4.40 a.m. At 4.5 a.m. he had a convulsive attack with a trismus-like condition and unconsciousness and cyanosis. The left pupil was dilated to the maximum, while the right pupil was middle-sized. At 4.10 a.m. spontaneous respiration ceased, and both pupils were dilated and did not react to light. Artificial respiration, venesection, and subcutaneous injection of lobelin were tried, but the heart gradually failed and ceased to beat at 4.40 a.m. In spite of the suddenness, the death was evidently of cerebral, and not primary cardiac, origin, but the pupillary dilatation observed pointed against pontine hæmorrhage.

NECROPSY (by Dr. W. Schosserer, December 13).

The heart showed great hypertrophy of the left ventricle; the thickness of the ventricular wall in front was 2·2 cm. The weight of the heart, without the root of the aorta, was 510 grammes (18 oz.). There was slight, patchy atheroma of the middle of the aortic arch and the proximal parts of the great arteries leading from it (innominate, left carotid and left subclavian). There was nothing to account for the aortic regurgitation noted during life, excepting slight arterio-sclerotic changes; all three aortic cusps were somewhat thickened, and the two anterior ones (those corresponding to the origins of the two coronary arteries) were adherent to each other; there was no obvious dilatation of the whole aortic orifice.

Just below the origin of the left subclavian artery there was typical abrupt diaphragm-like stenosis ("co-arctation") of the so-called aortic "isthmus." The

opening was funnel-shaped from above and just admitted the passage of a probe of about 2 mm. in diameter. There was certainly no patent ductus arteriosus, and Dr. Schosserer, following the fibrous band, which he thought (he was not quite certain) represented the remnant of the closed ductus, found that it was inserted into the aorta just above the stenosis. The pulmonary artery appeared normal.

Though immediately below the stenosis the aorta abruptly expanded to a good size, the abdominal aorta was certainly hypoplastic. The circumference of the thoracic aorta just proximal to the innominate artery was 7·8 cm.; just proximal to the left subclavian artery it was 6·7 cm.; just below the inferior mesenteric artery the circumference of the abdominal aorta was only 3 cm.

No attempt was made exhaustively to dissect out the *arterial collateral circulation*, which connected the portion of the aorta proximal to the isthmus-stenosis with the portion distal to it, but the internal mammary arteries were enormously enlarged. One of the long thoracic arteries was examined and found enlarged, but one of the inferior (deep) epigastric arteries, which was examined, was not much if at all larger than normal. The upper intercostal branches of the aorta were certainly hypertrophied, especially the first pair (the right one was larger than the left). The collateral circulation was evidently to a great extent carried on by the internal mammary arteries (which spring from the subclavian arteries) and their branches, which anastomosed with the intercostal arteries from the aorta below the stenosis. Doubtless many lesser channels of the compensatory collateral circulation would have been found had they been searched for.

The lungs, liver (weight, 1,750 grm.), spleen (weight, 150 grm.), and kidneys (weight of both kidneys together, 300 grm.), showed nothing special by naked-eye examination. Nor was anything special found in other abdominal viscera.

Brain.—There was a walnut-sized aneurysm in the left Sylvian fissure, which had burst and was surrounded by extravasated blood, occupying a cavity about double the size of the aneurysm itself. The hæmorrhage had not broken into the cerebral ventricles, nor into the subarachnoid space; it had partly destroyed the island of Reil, though it had not reached the external capsule. The basal ganglia appeared normal. Dr. Cecil F. Beadles, who prepared the specimen for the Museum of the Royal College of Surgeons, kindly wrote to me that the aneurysm took its origin from a branch of the left middle cerebral artery and lay in and distended the Sylvian fissure, pressing on the island of Reil. It was entirely hidden below and externally by the temporal lobe of the brain. In its collapsed state it measured a little over 2½ cm. (1 in.) in diameter.

The illustrations were drawn by Mr. S. A. Sewell, from the specimens, which are now in the Museum of the Royal College of Surgeons. Fig. 1 is a semidiagrammatic view of the heart and aorta, made before the heart was separated from the aorta, to show the position of the isthmus-stenosis, the origins of the enlarged aortic intercostal arteries, etc. Fig. 2 represents the back of the sternum and adjoining portions of ribs, to show the enormous compensatory hypertrophy and dilatation of the internal mammary arteries, through which the collateral circulation was largely carried on. Fig. 3 represents a section through the brain, the upper portions of the cerebral hemispheres having been cut away so as to show the position of the aneurysm in the left Sylvian fissure, pressing on the island of Reil and the external capsule. It should be remembered that at the post-mortem examination the aneurysm was surrounded by effused blood.

I must here thank Dr. O. Bode and Dr. J. Axhausen (house physicians) and Dr. W. Schosserer (who made the post-mortem examination) for their great help in the examination of the case, and Dr. C. F. Beadles, who prepared the specimens, which have been preserved.

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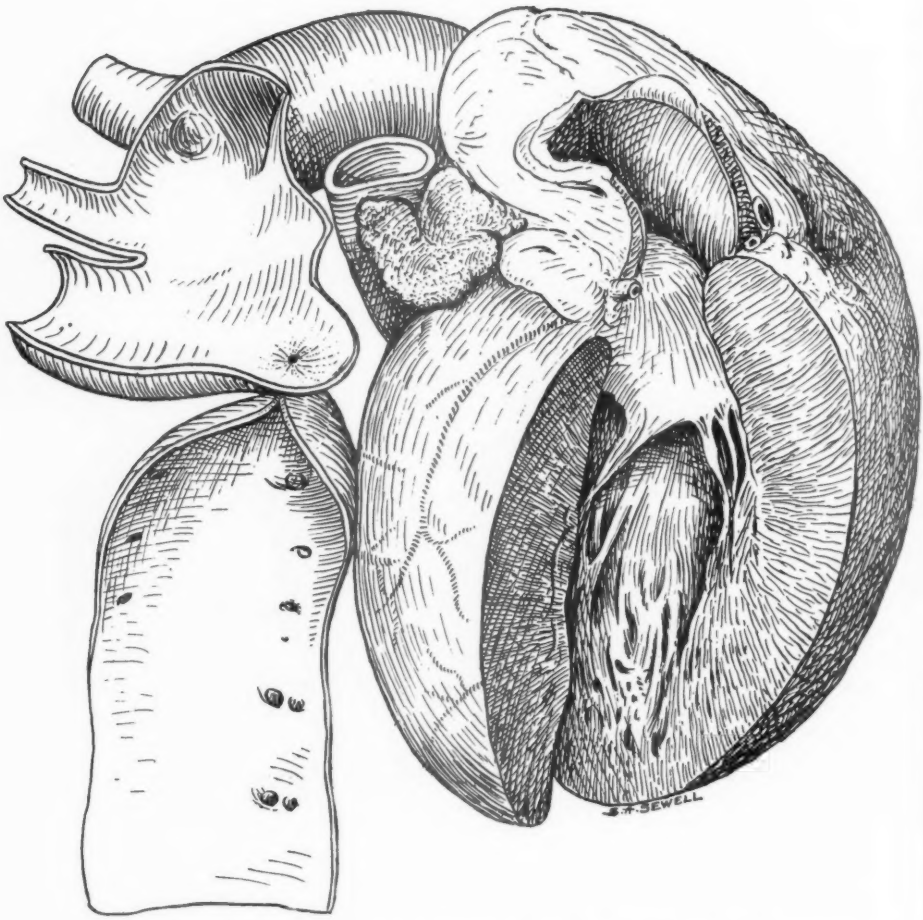

FIG. 1.—Dr. F. Parkes Weber's case of Stenosis of the Aortic Isthmus. Semi-diagrammatic view of the heart and aorta, to show the position of the isthmus-stenosis, the origins of the enlarged aortic intercostal arteries, etc.

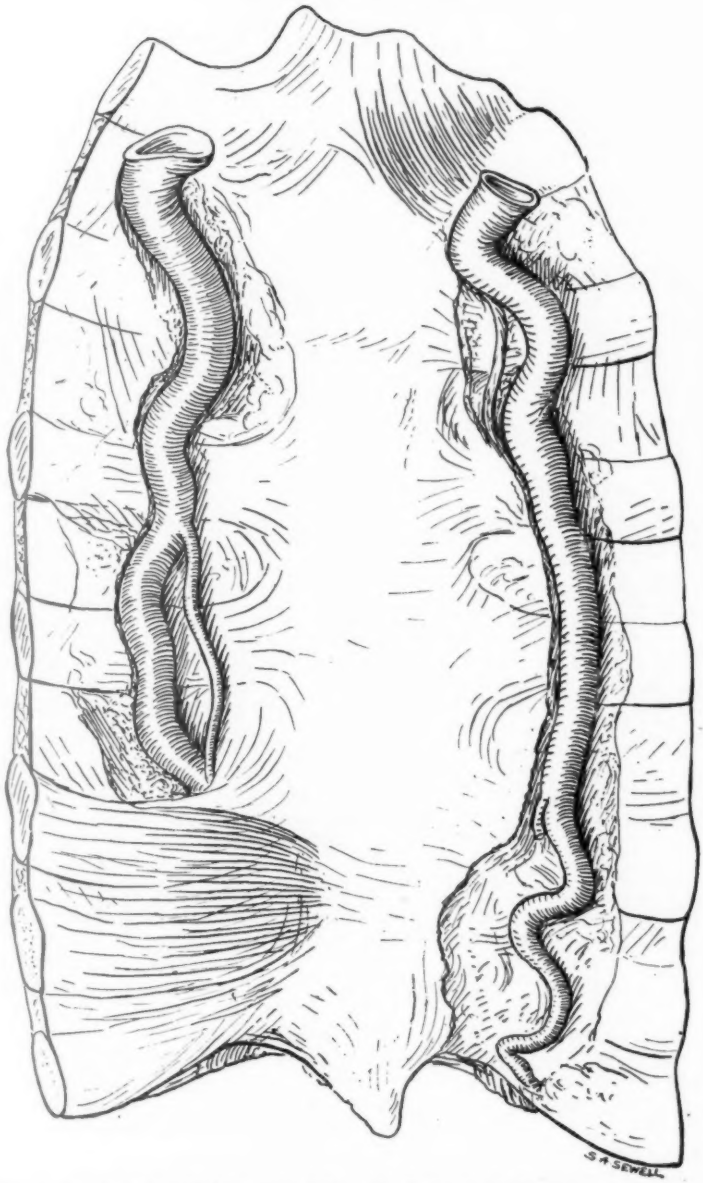

FIG. 2.—Dr. F. Parkes Weber's case of Stenosis of the Aortic Isthmus. The back of the sternum and adjoining portions of the ribs, to show the enormous compensatory hypertrophy and dilatation of the internal mammary arteries, through which the collateral circulation was largely carried on

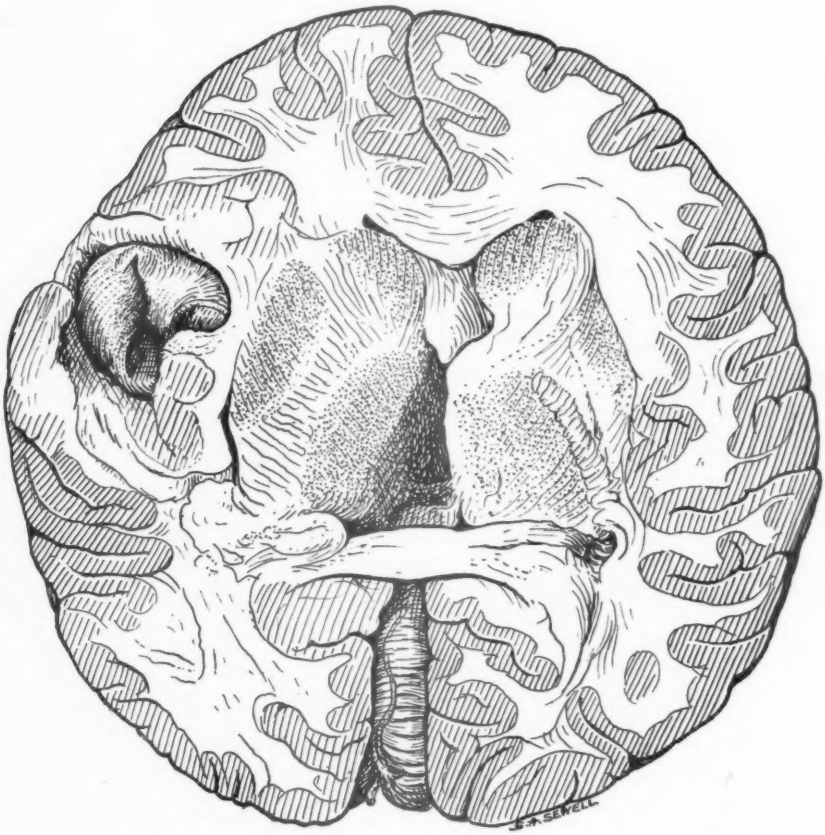

FIG. 3.—Dr. F. Parkes Weber's case of Stenosis of the Aortic Isthmus. A section through the brain, the upper portions of the cerebral hemispheres having been cut away, so as to show the position of the aneurysm, in the left Sylvian fissure, pressing on the island of Reil and the external capsule. It must be remembered that at the post-mortem examination the aneurysm was surrounded by effused blood.

DISCUSSION.

Recapitulation of the Present Case.—An adult man, capable of doing fairly laborious daily work, seemed in external appearance well, but presented all the ordinary physical signs of aortic valve regurgitation. There was no evidence of previous syphilis or rheumatic fever. An exceptional feature was the presence on the upper chest-front of a pair of subcutaneous arteries which could easily be felt pulsating. They passed symmetrically outwards, one on each side of the sternum. After transitory cerebral symptoms the patient died suddenly with signs somewhat similar to those of a pontine hæmorrhage, but with large instead of small pupils.

The necropsy showed that death was due to the rupture of a walnut-sized aneurysm in the left Sylvian fissure, originating in a branch of the middle cerebral artery. There was relatively little disease of the aortic orifice, but there was extreme stenosis (co-arctation) of the aortic isthmus of the so-called adult type, the arterial collateral circulation having been largely carried on by the enormously enlarged internal mammary arteries and their branches anastomosing with the intercostal arteries from the aorta below the stenosis. The pair of subcutaneous arteries felt pulsating in front of the chest during life were derived from "perforating" branches of the internal mammary arteries.

The "isthmus" is the portion of the aorta between the origin of the left subclavian artery and the insertion of the ductus arteriosus Botalli. It is of little functional importance in the scheme of the fœtal circulation, as before birth most of the blood distributed to the lower part of the body enters the aorta by the ductus arteriosus. After birth it has to adapt itself to the increased flow of blood accompanying the gradual closure of the ductus arteriosus. Thus it is not surprising that it is occasionally found to be the site of maldevelopment. Stenosis of the aortic isthmus—"co-arctation of the aorta," as it has been mostly termed in English literature on the subject—has, since Bonnet's analysis of cases (1903), usually been divided into two types. In the first or *infantile type* the stenosis or hypoplasia or complete atresia of the isthmus is already present at birth, and it tends to be more diffuse (less abrupt or diaphragm-like) than in the other type. It is often associated with other congenital malformations or abnormalities, including occasionally "mongolism," and the affected infants usually die soon.

In the second or *adult type* the stenosis (sometimes complete occlusion) of the isthmus is usually abrupt or diaphragm-like and other important congenital abnormalities are generally absent. An elaborate collateral arterial circulation gradually develops which connects the branches of the aorta proximal to the stenosis with those of the aorta distal to the stenosis. In some cases of the "adult type" minor, fairly common congenital abnormalities have sometimes been noted, such as the presence of only two aortic cusps or congenital union of two of the cusps. In one case (Bonnet) congenital pulmonary stenosis was found, and in one case (K. Bahn) there was congenital dextrocardia (see further on), without complete transposition of viscera. In most cases of the adult type the ductus arteriosus is completely closed and represented only by an ordinary ligamentous band, which is found to be inserted into the aorta at or near the site of the stenosis, often just above it. In extremely rare cases, probably not of the adult type, the stenosis has been between the origins of the left carotid artery and left subclavian artery, instead of distal to the latter, the ductus arteriosus in these cases having been apparently inserted into the aorta proximally instead of distally to the origin of the left subclavian artery, the aortic "isthmus" being therefore proximal instead of distal to the latter. But I shall refer further on to Deneke's writing on the subject.

The adult type, unlike the infantile type, which is supposed to represent a true congenital developmental abnormality, is never found, according to Maude Abbott (see further on), in the fœtus, nor after birth before the closure of the ductus arteriosus has commenced. It is generally explained on Skoda's theory (1855), or Brunner's modification (1888) of it, that the aortic isthmus in these cases contains tissue resembling and derived from that of the ductus arteriosus, this tissue contracting after birth when the ductus arteriosus normally contracts.

What can be said with certainty is that in subjects with any considerable degree of isthmus-stenosis who survive childhood, an elaborate system of collateral arterial circulation gradually develops through the anastomoses of the internal mammary and other branches of the subclavian arteries, and generally the long thoracic and

subscapular branches of the axillary arteries, from above, with the thoracic arteries (branches of the aorta) and other arteries below. So efficient may the collateral circulation be that those who survive childhood (when the collateral circulation is being established) can often carry on an occupation that necessitates laborious muscular effort, and in some cases may show only moderate, or even no, hypertrophy of the left ventricle. Probably about half of those surviving childhood die between 20 and 40 years of age, the period of strenuous adult life; yet a considerable minority live longer, exceptionally to old age. The pulsation in the arteries of the lower limbs is often feeble, but very rarely are there actual signs of insufficient arterial blood-supply in the legs (weakness, tendency to coldness or even intermittent claudication). If the condition were recognized in early life an occupation should be chosen that does not necessitate excessive muscular activity, especially of the legs.

Death in these cases is often directly or indirectly due to the stress thrown on the heart and the aortic arch and its great branches by the need of providing an efficient blood-supply, through the tortuous collateral circulation, to the legs, etc. Thus, there is a tendency to atheromatous and "compensatory sclerotic" changes in the aorta and aortic valves. The first portion of the aorta is often dilated, as has been shown in several cases by Roentgen-ray examinations during life. It is therefore not surprising to hear of rupture of an aortic aneurysm as an occasional cause of death in these cases. A woman, aged 56 years, whom I saw in 1910 (referred to further on), died from the external rupture of an aneurysm on the right side of her neck. Similarly, the excessive blood-pressure in the arteries derived from the aorta proximal to the stenosis doubtless accounts for cerebral hæmorrhage having occasionally been noted as a terminal event, but I do not know of a case other than the present one in which a large cerebral aneurysm was present. It is quite possible that the cerebral aneurysm in this case developed at a congenitally weak spot in the artery, just as an aneurysm or rupture without aneurysm may probably occasionally occur at congenitally weak spots in the aorta or other arteries.

The previous latency of the cerebral aneurysm in the present case and the absence of optic neuritis may be accounted for by its slow development and its position on the outside of the brain. It is curious that, according to the history obtained, the left side of the body seemed to be chiefly affected in connexion with the preliminary cerebral attack before the patient's admission to hospital.

Probably in many cases of stenosis of the aortic isthmus of the adult type there are clinical signs of aortic regurgitation, but without a history of acute rheumatism or evidence of past syphilis. The aortic regurgitation in these cases is probably due to the excessive strain on the proximal aorta and simple atheromatous or sclerotic changes in the valves. Furthermore, according to Minkowski (see below) aortic regurgitation is apt to be diagnosed in these cases when it is not really present. Indeed, when the stenosis of the aortic isthmus has not been discovered, aortic regurgitation (of uncertain origin) has probably been the clinical diagnosis most frequently adopted. In the present case, however, a clinical diagnosis of isthmus-stenosis could have been established had our examination been more complete.

The most important signs in the differential diagnosis of isthmus-stenosis are those furnished by the collateral arterial circulation and the weakness of the pulse in the arteries of the lower extremities as compared with the pulse in the upper extremities. In the patient in question, though by careful palpation no superficial pulsating arteries could be felt over the back, yet on the upper part of the front of the thorax two symmetrically placed superficial pulsating arteries could be felt, which were evidently derived from the internal mammary arteries, and these latter are invariably greatly enlarged in cases of stenosis of the aortic isthmus of the adult type. With this diagnostic clue in our possession, had we then examined the

pulsation in the arteries of the lower extremities we should doubtless have arrived at the certain diagnosis. For in cases of isthmus-stenosis, as above stated, the pulsation is greatly diminished or not to be felt by ordinary palpation in the arteries of the lower limbs in which in ordinary persons it can be easily felt. This is, of course, owing to the tortuous collateral circulation which has to be traversed for the blood to reach the lower extremities from the heart.

In most cases not much diagnostic information can be obtained from Roentgen-ray examination of the thorax, excepting that generally the heart is enlarged to the left and the first portion of the aorta is dilated. In one case, however, to which I shall refer further on, and in which I had the opportunity of palpating the superficial collateral circulation, Dr. A. M. Gossage thought that the descending thoracic aorta could, in a Roentgen skiagram, be seen to end at the third dorsal vertebra, apparently the site of the isthmus-stenosis. In every case, and in every doubtful case, Roentgen-rays should be used to ascertain as far as possible the presence or absence of a thoracic aneurysm.

In some cases the pulsating clusters of tortuous superficial arteries involved in carrying on the collateral circulation have given the observer the sensation of cirsoid aneurysms. The present is the only case I know of in which no pulsating arteries could be felt on the back, especially between the scapulæ, though two could be felt on the upper front of the thorax.

More cases of the adult type have been recorded in males than in females. Of the patients who survive childhood most die between 20 and 50 years of age, perhaps half between 20 and 40. The present patient reached the age of 40 years.

Although stenosis of the aortic isthmus is very rare, at the very least 250 cases have been already recorded. I shall now give some illustrative notes from the extensive literature on the subject.

Notes from the Literature of the Subject.

Morgagni [1] in his celebrated work, *De Sedibus et Causis Morborum* (1761), was perhaps the first to describe a case. The patient was a man with dyspnœa and lividity of the face and neck. The heart was enormously enlarged, especially on the right side, and, according to Morgagni's description, there was an extraordinary contraction of the aorta near to its origin. This case is obviously doubtful, but what other kind of aortic contraction could have been present, excepting general hypoplasia, which is not likely to have been meant?

A French prosector in Paris, named Paris, was apparently the first to describe an undoubted case in 1789. The aorta of a woman, aged about 50 years, was found to be stenosed in the neighbourhood of the insertion of the ductus arteriosus, and a typical collateral circulation had developed. From the commencement of the thoracic aorta Paris was able easily to inject the abdominal aorta and its branches. The case was published in the second volume of the *Journal de Chirurgie de Desault* (Paris, 1789), but I have seen only the English translation, by R. Gosling, which was published in London in 1794 (*Parisian Chirurgical Journal*, second volume, p. 104).

On July 19, 1813, at the Medical and Chirurgical Society of London, Sir Gilbert Blane communicated the account of a "Case of Obstructed Aorta" for Robert Graham, M.D. [2], one of the physicians of the Royal Infirmary, Glasgow. The patient, a boy, aged 14 years, working as a weaver, died apparently from some febrile thoracic disease that had nothing to do with his aortic condition. The heart was about twice the normal size. The aorta was somewhat dilated near its origin, but distally to the left subclavian artery it became contracted and just below its union with the closed ductus arteriosus it became completely impervious; immediately below this stricture it acquired nearly its natural size. The collateral circulation in this case was apparently largely carried on by the internal mammary arteries and their branches from above the stenosis anastomosing with the enlarged intercostal arteries from the aorta below the stenosis. Graham said that the case most nearly resembling his case was that published by Paris in *Desault's Surgical Journal*, but that unfortunately Paris gave no account

whatever of the symptoms that were present during life. In Graham's case (compare the illustrations accompanying his description) there was some general narrowing of the whole aortic isthmus as well as complete occlusion ("complete co-arctation," according to later English medical nomenclature) just distal to the insertion of the ligamentous band representing the closed ductus arteriosus.

In 1828, A. Reynaud [3] published the interesting case of a man who, in spite of extreme isthmus-stenosis, lived to the advanced age of 92 years. The old man's heart was said to be of normal size, and this, if even approximately correct, proves that the collateral circulation must have been almost perfectly efficient and helps to account for his advanced age at death. It should also be noted that his occupation of shoemaker did not necessitate heavy muscular work, at all events with his lower limbs.

J. F. Goodhart described two cases of isthmus-stenosis in 1875 [4]. The first was that of a man aged 27 years. The two anterior aortic cusps (those corresponding to the origins of the coronary arteries) were adherent; the posterior aortic cusp was thickened.

E. Barié, in 1886 [5], collected together a number of different observations, including Reynaud's case, under the heading, "On Congenital Stenosis of the Descending Aorta."

W. L. Dickinson and W. J. Fenton, in 1900 [6], described a case of complete occlusion ("complete co-arctation") of the aortic isthmus in a man, aged 29 years, somewhat ill-developed, under the care of Sir Humphry Rolleston at St. George's Hospital, London. Death occurred from cardiac dropsy. During life apparently the case had resembled one of aortic regurgitation, but there was no history of rheumatism or chorea, and on one occasion the then medical registrar, T. R. Whipham, observed arterial pulsation in the back, between the left scapular and the spine, which of course represented part of the collateral arterial circulation. At the necropsy, apart from the occlusion of the aortic isthmus, the aortic valve was incompetent to water; it was made up of only two cusps, an anterior and a posterior one, both of which were stiff and thickened. According to Dickinson and Fenton, though stenosis of the aortic isthmus was a rarity, complete occlusion was an extreme rarity. They estimated that out of 105 cases of "co-arctation" there were fourteen cases of complete co-arctation (complete occlusion). In a considerable minority of known cases death had been due to rupture of a saccular or dissecting aneurysm of the aortic arch, and apart from actual aneurysm there appeared to be a noteworthy liability to rupture of the aorta and even of the heart itself.

Minkowski [7], in March, 1901, at the General Medical Association of Cologne, demonstrated a young man, aged 23 years, with stenosis of the aortic isthmus and signs at first suggesting the presence of aortic regurgitation. The brachial systolic blood-pressure was 300 mm. Hg. The presence of a typical arterial collateral circulation made the diagnosis of isthmus-stenosis certain, but it seems to me, in spite of what Minkowski says to the contrary, that true aortic regurgitation may also have been present, as in my case. According to Minkowski, isthmus-stenosis had already been found in about 120 post-mortem examinations, but was seldom recognized during life. In about thirteen of these cases death had been due to aortic rupture, and cerebral hæmorrhage had been repeatedly observed.

In L. M. Bonnet's elaborate paper (1903) [8], "On the Lesion called Congenital Stenosis of the Aorta in the Region of the Isthmus," an "infantile type," observed in newly-born children, was separated by him from the "adult type," with which we are chiefly concerned. The differences between the infantile and the adult series have been already referred to (see above). Of his 160 cases, fifty-five were of the infantile type and 105 of the adult type. Amongst the adult series there were ten cases in which aortic aneuyrsm of some kind was said to have occurred.

John Fawcett (1905) [9] made use of the necropsy records at Guy's Hospital, London, between 1826 and 1902, to illustrate the subject of "co-arctation of the aorta." Out of the notes on some 22,316 necropsies he found only eighteen cases of isthmus-stenosis, in one of which there was complete obliteration ("complete co-arctation"). The sex in nine cases was male and in eight cases female; in one case it was not stated. In at least six of the cases the ductus arteriosus was found to be open, though it is generally believed to be closed in nearly all cases of the adult type. In three cases no marked enlargement of the heart was found. In the majority of the cases there was evidence of a chronic inflammatory change in the aortic valves, supposed to be due to the constant strain to which they were subjected owing to the isthmus-stenosis. This chronic inflammatory change had led to the

valves becoming thickened or adherent or had produced stenosis of the aortic orifice. In no less than ten of the cases the aortic valves were affected, and in six of them there were mitral valve changes of similar nature. In three cases the valves were apparently healthy. There was no mention of any dilatation of the aorta immediately below the stenosis. In one case death was due to the rupture of a small aneurysm on the proximal side of the obstruction. In one case the aorta was described as having cracked over a patch of atheroma distal to the constriction and showing an early stage of dissecting aneurysm. In one case a larger saccular aneurysm arose from the ascending portion of the thoracic aorta. The aorta distal to the stenosis was described as small in several cases; in two of these cases the vessel walls distal to the stenosis were also thin. In another case the walls proximal to the stenosis were thin. In eight of the eighteen cases the isthmus-stenosis was accompanied by various congenital malformations. These latter were most numerous in three cases, in whom death had taken place at the ages respectively of 5 months, 16 hours, and $2\frac{3}{4}$ years—examples, I suppose, of Bonnet's "infantile type" of isthmus-stenosis. In none of the eighteen cases was the diagnosis of isthmus-stenosis made during life. I would point out also that isthmus-stenosis has probably sometimes been overlooked in hasty post-mortem examinations.

G. Carpenter (1908) [10] described a case of isthmus-stenosis of the adult type in a boy, aged 5 years, with greatly enlarged superficial arteries of the collateral circulation. He believed the boy to have congenital syphilis.

In 1908 Maude E. Abbott, in her article on "Congenital Cardiac Disease" in Osler and McCrae's "System of Medicine," contributed an excellent analytical article to the subject of "co-arctation of the aorta." To Bonnet's 160 cases she was able to add thirty-eight more, and so obtained a total of 198 cases for her analysis. Of these cases 129 occurred in patients over one year old. Seven patients died in the sixth, and six in the seventh decade of life, whilst one (Reynaud's case, already alluded to) lived to the age of 92 years. More than half of the remainder (fifty-six cases) died between the ages of 20 and 40 years. In 121 of the 129 cases the sex was known; it was male in eighty-one, female in forty. There was some evidence of collateral circulation in fifty-six of the 129 cases, but the particular branches involved and the size of the anastomotic arteries varied greatly, even in cases in which the aortic stenosis was extreme. The heart was stated to have remained normal throughout life in nine of the 129 cases, including Reynaud's case of a man aged 92 years (already referred to); Brunner's case, in which there was an actual obliteration of the aortic channel at the insertion of the ductus arteriosus; and Dumontpallier's case (the patient was aged 39 years), in which the aortic stenosis was due to a septum with a central aperture, 13 mm. in diameter. Seventy-seven cases showed marked hypertrophy and dilatation of the heart, but forty-four of them were complicated with chronic valvular lesions or other cardiac defects, which might have given rise to cardiac hypertrophy. Hence it appears that hypertrophy of the heart is not an invariable consequence of aortic co-arctation. According to Abbott, aneurysm of the aortic arch occurred in only nine of the 129 cases, and in five of them it was of the dissecting form; rupture of the aorta occurred in twelve cases, of the ascending aorta in seven cases, and at the site of the stenosis in five cases.

In Dr. Abbott's article in the second edition of Osler and McCrae's "System of Medicine" (1915), the total of 198 cases was brought up to 212 cases [11].

A. M. Gossage, in April, 1909 [12], at the Clinical Section of the Royal Society of Medicine, demonstrated a boy, aged 17 years, with the characteristic clinical signs of the adult type of stenosis of the aortic isthmus, including the subcutaneous thickened tortuous arteries of the collateral circulation. The clinical diagnosis was shown to be correct in November, 1911, when the boy died. A complete account of the case, together with the necropsy, was published in 1912 by R. O. Moon [13]. The complicating presence of chronic nephritis should be noted in this case.

Hugo Sella (1910) [14] described a case of extreme stenosis of the aortic isthmus in a man, aged 43 years, with perforation of a dissecting aortic aneurysm into the pericardium. Here I will allude to a demonstration by P. Fraenckel, in 1913, before the Hufeland Society [15]. Fraenckel maintained that in cases of rupture of the ascending aorta in young persons the cause was not very rarely to be found in the presence of stenosis or complete occlusion (atresia) of the aortic isthmus. He referred to cases in illustration.

In A. Brown's case of the adult type (1912) [16] the large tortuous superficial arteries of the collateral circulation were variously disposed over the right thoracic wall.

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In 1912, with Dr. F. W. Price [17], I published a case of isthmus-stenosis in a woman, aged 56 years. Death was due to the external rupture of a large aneurysm in the neck, and although there was no post-mortem examination, the superficial collateral arterial circulation observed during life left no doubt as to the correctness of the diagnosis. There were numerous enlarged and tortuous superficial arteries at various parts of the trunk, neck and limbs, but these were especially remarkable in both axillæ and on both sides of the back in the infrascapular regions. The superficial arteries on the trunk could be felt pulsating under the skin, and some of them were so enlarged as to be nearly as thick as a man's little finger. The patient had lived a very active life, but had felt weaker during the last three or four years, and for two years the aneurysmal swelling in the neck had been visible. She had had eleven children, of whom seven were still living.

F. Langmead (1912) [18] demonstrated before the Clinical Section of the Royal Society of Medicine the case of a married woman, aged 55 years, the mother of thirteen children, twelve of whom were alive and well. A diagnosis of thoracic aneurysm, not connected with the aorta, was suggested by Dr. Langmead. In the discussion [19] I argued that the only way to account for the enlargement of the superficial arteries on both sides of the back of the thorax was to assume that the enlarged arteries in question formed part of an elaborate collateral circulation to compensate for stenosis or possibly complete occlusion of the isthmus of the aorta just beyond the origin of the subclavian artery. Later in the year the case was again demonstrated before the Society by Dr. A. M. Gossage [20]. The Wassermann reaction, as obtained both by Dr. Langmead and Dr. Gossage, was negative. Roentgen skiagrams of the thorax, taken in various positions by Dr. Worrall, seemed to show that the aorta ended at about the third dorsal vertebra. The brachial blood-pressure was, systolic, 200 to 225 mm. Hg; diastolic, 100 mm. Hg. The diagnosis of isthmus-stenosis was practically certain, but the explanation of the skiagraphic appearance was not easy to understand.

H. Bergmann (1918) [21] described a case (with post-mortem examination) of a female child, aged 5½ years, with congenital occlusion of the aortic isthmus associated with general muscular hypotonia and slight mongolism. This, I suppose, was an instance of survival beyond infancy with Bonnet's "infantile type" of isthmus-stenosis associated with multiple congenital maldevelopment. There was likewise (apparently acquired) mitral stenosis, with cerebral disease, probably of embolic origin. In regard to the combination of isthmus-stenosis with endocarditis of the mitral valve, Bergmann refers to a very old published observation of Härlin, and also to one of Eppinger (1871).

Bronson and Sutherland (1918) [22] record the case of a male child, aged 5 years and 10 months, in whom death was due to the rupture of a fusiform aneurysm of the ascending arch of the thoracic aorta. The post-mortem examination showed likewise partial stenosis of the isthmus of the aorta between the origin of the left subclavian artery and the insertion of the (normally obliterated) ductus arteriosus. Other features present were congenital diaphragmatic hernia, subluxation of joints and defective cranial development. They considered the aortic aneurysm to be due to a congenital defect in the development of the aorta. This case should, I suppose, like the preceding one, be classed with Bonnet's "infantile type" of isthmus-stenosis, associated with multiple maldevelopment.

H. J. Starling, at Norwich, in 1920 [23], demonstrated a man, aged 40 years, with the typical clinical signs of stenosis or occlusion of the aortic isthmus. He had begun to suffer from dyspnœa in 1916 when serving in the army in Mesopotamia. The brachial blood-pressure was, systolic, 255 mm. Hg; diastolic, 148 mm. Hg. Pulsation could hardly be detected in the abdominal aorta and the femoral and popliteal arteries. There was a mass of varicose arteries in each axilla, and tortuous superficial arteries of the collateral circulation could be felt under the skin in various parts of the trunk.

B. T. Parsons-Smith (1921) demonstrated a case of the adult type of stenosis or complete occlusion of the aortic isthmus in a man, aged 24 years, under the heading "Case of Congenital Aortic Atresia" [24]. The patient's general physical incapacity became manifest in 1915, when training for military service, but nevertheless, in 1916 he again entered the army, and in spite of recurring disabilities (pain in the chest, bronchitic attacks, shortness of breath, etc.) he remained, at full duty for the greater part of the time, until he was invalided for further service in October, 1917. The arterial pulses in the lower extremities were smaller than

normal in comparison with those in the upper extremities. The brachial blood-pressure was, systolic, 144 mm. Hg; diastolic, 100 mm. Hg. The presence of a typical collateral arterial circulation was indicated by several thick-walled and tortuous superficial arteries in the scapular region.

Deneke (1925) [25], in a clinical paper on a case of stenosis of the aortic isthmus in a man, aged 46 years, discussed the question whether the stenosis in his case might not be situated between the origins of the left carotid and left subclavian arteries instead of, as in nearly all cases (see above), at the usual site of the isthmus (distal to the left subclavian artery). At all events measurements of the brachial systolic blood-pressure in the right arm gave readings of 185 to 220 mm. Hg, whilst the readings for the left arm were 106 to 120 mm. Hg (hardly more than half). In a few post-mortem examinations, probably only in infants, the aortic stenosis or atresia has been found between the origins of the left carotid and left subclavian arteries. Deneke refers to Bonnet's paper in illustration of this, and in 1912 A. Hayashi [26] described such a case (complete atresia) in a boy aged six days.

K. Bahn (1925) [27] described the case of a shepherd, aged 40 years, with *isolated* congenital dextrocardia, that is to say, without complete transposition of viscera. In addition he had the signs of stenosis of the aortic isthmus. He developed endocarditis maligna lenta, and the post-mortem examination showed complete occlusion of the aorta at the insertion of the ligament representing the fœtal ductus arteriosus, distal to the origin of the left subclavian artery. There was a well-developed collateral arterial circulation. The actual cause of death was cerebral embolism. The same case was described by Pol [28], according to whom about 150 cases of stenosis and about twenty-five cases of complete occlusion of the aortic isthmus were known of from the literature on the subject.

J. T. King, jun., in an excellent paper (1926) entitled, "Stenosis of the Isthmus (Co-arctation) of the Aorta and its Diagnosis during Life" [29], reports four original cases. An interesting clinical feature of his first case, that of an Italian labourer, aged 35 years, was a kind of intermittent claudication of the lower extremities, showing that the collateral circulation was not perfectly efficient. An elaborate bibliography of the subject to date is appended, to which all those interested in the subject may be referred. In this paper and in another one of the same year [30] King contrasts the symptomatology of isthmus-stenosis with the clinical features of the rare condition of generalized aortic hypoplasia, according to Joseph Burke's analysis of twenty cases of the latter condition in 1901 [31]. In Burke's cases there was no collateral arterial circulation analogous to that in adult cases of isthmus-stenosis. Of Burke's twenty cases seventeen were in men and three in women; the average duration of life was 23·8 years, the patients mostly dying with symptoms of myocardial insufficiency, commencing suddenly less than a year before death. In one of Burke's cases there was a kind of intermittent claudication.

Summary.

A case is described of stenosis (co-arctation) of the aortic isthmus in a middle-aged man, with sudden death from rupture of a cerebral aneurysm. An important clinical diagnostic feature in the case was the presence of two enlarged subcutaneous arteries on the upper chest-front, which could easily be felt pulsating and which were derived from the extremely enlarged internal mammary arteries. No superficial pulsating arteries could be felt over the back or, excepting the two above-mentioned ones, elsewhere on the trunk. The clinical and pathological features of such cases and the literature on the subject are briefly considered. Obviously, could the diagnosis be made early in life, an occupation involving great muscular work, especially of the legs, should be avoided. The clinical diagnosis in these cases is frequently aortic regurgitation, whether true aortic regurgitation is present or not.

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Postscript (April 27, 1927).—An interesting case of stenosis of the aortic isthmus, of the "infantile type," in a boy who died forty hours after birth, has been recently described by J. W. Bruce and R. Ball, *American Journal of Diseases of Children*, Chicago, 1926, xxxi, p. 196. To Dr. G. Jefferson I am indebted for reference to a valuable paper from the Mayo Clinic at Rochester, by H. W. Woltman and W. D. Shelden, *Archives of Neurology and Psychiatry*, Chicago, 1927, xvii, pp. 302-316. Their search through the literature disclosed thirty-two cases of stenosis of the aortic isthmus in which some neurological complication was present, and they themselves describe the case of a young man, aged 20, who died with rupture of a cerebral aneurysm, situated at the junction of the left middle cerebral artery with the left posterior communicating artery. They also describe another case of isthmus-stenosis (the clinical diagnosis being practically certain), in a woman, aged 44, who suffered from intermittent claudication of the lower extremities, as in one of the cases recorded by King (see above).—F. P. W.

Section of Neurology.

President—Sir JAMES PURVES-STEWART, K.C.M.G., C.B., M.D.

Cases shown at the Clinical Meeting held at the National Hospital for the Paralysed and Epileptic, Queen Square, W.C.1, March 10, 1927.

Bilateral Ulnar Neuritis in Association with Skeletal Deformities: Hypertelorism.

By C. P. SYMONDS, M.D. (shown by Dr. REDVERS IRONSIDE).

T. D., AGED 58, attended Neurological Out-Patients' Department at Guy's Hospital on February 26, 1927. Family history unknown. Previous health good. For many years sensibility over the skin of the right little finger has been impaired.

Four weeks ago he fell 6 ft. on to the right elbow. Since then his grip has been impaired so that he cannot continue his work.

Signs of bilateral ulnar nerve palsy with clawing of the two ulnar fingers and wasting of the small muscles of the hands, hollowing of the palms and flattening of the hypothenar eminences. Sensory loss to all forms of stimulation over the ulnar border of the right hand. Both ulnar nerves lie exposed over deformed external condyles and are thickened and hard to the touch.

Brachycephalic. Eyes set so wide apart that stereoscopic vision is not possible. Prominent frontal eminences, bridge of the nose flattened. Congenital divergent squint. Terminal phalanx of right little finger deficient. Fundi both show marked appearance of medullated nerve fibres. Intelligence normal.

Case of Syringomyelia with Hydrocephalus and Coarse Tremor (Fibrillation) of the Right Hand.

By C. P. SYMONDS, M.D. (shown by Dr. REDVERS IRONSIDE).

A. T., AGED 43, attended Neurological Out-Patients' Department at Guy's Hospital on February 9, 1927. For the past three years patient has had attacks of throbbing in the left temple associated with vomiting and double vision. These attacks came every fortnight, but he has not had one now for twelve months.

Four months ago he began to notice coldness and stiffness of both lower limbs. Both legs drag, especially the right.

About the same time the right hand began to shake and he noticed a weakness of the fourth and fifth fingers of that hand. Occasionally there has been numbness of the same fingers of the left hand. He has had difficulty in holding his water.

Patient states that his head has always been large and he has difficulty in getting suitable headgear.

On examination: head large, especially transtemporally. Slight swelling of the left optic disc. Slight double ptosis. Fibrillation of the tongue.

There is wasting of the intrinsic muscles of both hands, and clawing of the third and fourth fingers of the right hand. Wasting of the right forearm muscles (ulnar). There is an extremely coarse tremor of the fingers of the right hand, and fibrillation of the hand muscles and the ulnar muscles of the forearm. Legs spastic.

Impairment to pressure pain and hot and cold over the right C.8 and Th.1 segments. More extensive impairment to cold over C.6 to L.3 on the left side of the body. Loss of sense of position in toes of the right foot. Vibration sense absent on vertex and tibial malleoli, impaired over radial styloids.

Tendon reflexes all very brisk. Bilateral ankle clonus. Bilateral extensor plantar responses.

Two Cases of Familial Pes Cavus, with Absent Knee- and Ankle-Jerks (Peroneal Type of Muscular Atrophy).

By A. FEILING, M.D.

Case I.—T. K., AGED 6.

Mother complains that patient said his legs ached.

Has a sister, aged 8, who has deformity of feet (Case II); one uncle and one aunt have had many operations for deformity of feet; one great-uncle and one great-aunt also had similar trouble.

Examination.—Healthy boy. Cranial nerves normal. Arms normal. Legs thin: right > left. No localized wasting. Pes cavus with equino-varus; right much more marked than left; flaccid type. Knee-jerks and ankle-jerks absent. Plantars doubtful. No loss of sensation found.

Electrical reactions: Normal response to faradism.

X-ray of lumbo-sacral region showed no abnormality.

A maternal uncle and aunt, and two members of the previous generation were affected.

Case II.—O. K., AGED 8. Sister of T. K. Similar condition to that of brother, but not quite so marked; right foot chiefly affected.

No other symptoms.

No history of acute illness in either.

A Case of Schilder's Encephalitis with a Family History of the Disease.

By C. P. SYMONDS, M.D.

W. P., AGED 11.

Family History.

(A) *Of Parents.—Father,* aged 48; has enjoyed good health, except for an attack of anthrax. Has had defective vision since the age of 12.

Mother died of phthisis one year ago.

(B) *Of children.*—(1) *Male.*—Died aged 2 weeks. Cause unknown. (2) *N. P.,* female, aged 20. Now in Leavesden Mental Hospital; said to have been backward and invalid since birth. Never walked. Has never had any fits. Limbs seemed to become progressively weaker and stiffer as she grew older. Vision thought to be normal by the relatives when she left home for Leavesden Hospital in 1918.

Seen at Leavesden in December, 1926, by the kindness of Dr. R. M. Stewart, who had already made the suggestion that the case might be one of Schilder's encephalitis.

Mentally, she is an imbecile. Vision is very imperfect, but she can apparently distinguish light and darkness. The optic discs are pale and clear cut, the appearance being that of primary optic atrophy; the pupils are dilated and do not react to light; there is divergent strabismus, but no definite ocular paresis; no nystagmus. The right face is weaker than the left when she cries. As she lies in bed the head

is somewhat retracted. Both the upper and lower limbs are paralysed and spastic in flexion.

(3) *F. P.*, male, aged 18.—Now in Rotherhithe Infirmary with phthisis.

(4) *Female.*—Died at home at 13 months from "meningitis."

(5) *Female.*—Died in the infirmary at 13 from "meningitis."

(6) *J. P.*, female, aged 15.—Alive and well.

(7) *W. P., male, aged 11. Patient shown.*

(8) ? *Sex.*—Died aged 7 months from "meningitis."

(9) ? *Sex.*—Died aged 9 months from "convulsions."

(10) *T. P.*, male.—Said to have been normal up till last year, when, at the age of 6, he was admitted to Guy's Hospital with progressive bilateral weakness. The diagnosis of Schilder's encephalitis was made during life and confirmed at autopsy. (Brain shown.)

(11) *Male.*—Died at 9 months from "meningitis."

(12) *A. P.*, male, aged 3.—Alive and said to be in good health.

(13) *R. P.*, female, aged $1\frac{1}{2}$.—Alive and said to be in good health.

W. P., aged 11. Has been under observation for the last five years.

As an infant, he developed normally, but he began to suffer from fits at the age of 2; this being attributed at the time to a slight head injury. Subsequently, there were convulsive attacks at irregular intervals. According to the mother, these would usually begin with convulsive twitching of the right face, arm and leg, the convulsions would then become generalized and the patient would lose consciousness.

He was first admitted to Guy's Hospital in April, 1919, during one of his attacks, which had begun as usual with right-sided convulsive movements. On admission he was unconscious, but quickly recovered.

Under observation he was thought to be mentally backward and nervous. No localizing signs were found and he was discharged with the diagnosis of Jacksonian epilepsy.

He was re-admitted in July, 1919, and was said on this occasion to have had a left-sided Jacksonian attack. On this occasion he was seen by Mr. H. L. Eason, who noted defective vision, especially in the lower fields, and optic atrophy. The Wassermann was negative in the blood. Diagnosis of cerebral tumour, unlocalized, was made and he was discharged.

Following this, he had no more attacks until September 14, 1922. On that day there was a series of convulsions, each beginning with twitching of the right angle of his mouth, spreading over the right side of the face, subsequently affecting the right arm and leg. He was admitted unconscious during one of these attacks. On the next day (September 15, 1922) the fits had ceased, but he was still unconscious. The deep reflexes on the right side were increased and the right plantar response extensor. On the 16th he was conscious, but remembered nothing since going to bed on the 14th. The reflexes were as before.

I saw him for the first time on September 22, 1922, and made the following notes:

"*Cerebration.*—Odd, over-active. Speech: normal.

"*Special Senses.*—Vision: acuity very fair to rough tests. Fields: some peripheral constriction, especially on right. Discs white and clear-edged, some pigment disturbance around, vessels a fair size, cups not very distinct. I think a primary atrophy.

"*Cranial Nerves.*—Pupils dilated with atropine, neither eye turns in very well on conjugate deviation. Slight weakness of right face on emotional movement, otherwise normal.

"*Sensation.*—No defect of sensation.

"*Motor System.*—Left grip better than right, but says he is left-handed.

"*Reflexes.*—All tendon jerks present and equal on the two sides. Abdominals

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upper and lower present and equal on the two sides. Plantar responses: right doubtful, left flexor.

"*Sphincters.*—No disturbance of sphincter control. Walks on a rather wide base and is unsteady. Occiput, if anything, a little to the right; no constant deviation.

"*Impression.*—Cerebro-cerebellar atrophy."

He was again admitted in February, 1925, and was then reported to have had mild fits once a fortnight, or oftener, since his discharge from hospital in 1922. The account given by his mother was that on these occasions, if playing in the street, he would run inside and lie down; after a minute or two, twitching would begin in the right side of the face and extend to the arm and leg; this would continue for a few minutes; after that he would feel quite well again and ready to go out to play. Consciousness was not always lost in these attacks. On the day of admission an attack of this kind was followed by a series of fits, during one of which he was admitted. Chloroform was given to control the convulsions, which subsided, leaving him dazed and confused. He was discharged ten days later.

Following this, the fits were continued at irregular intervals, but these lost their Jacksonian character and became generalized. The story now is, that he is found unconscious, having fallen down.

He was re-admitted in December, 1926, for a month's observation, during which he had one brief attack; he was heard to grunt but, by the time the nurse reached his bed, there was no convulsive movement and he appeared dazed, but was not unconscious.

On examination the physical signs were as before. Physically and mentally he is under-developed, and the optic discs show primary atrophy with general constriction of the fields. An occasional extensor response can be obtained on both sides; otherwise there are no abnormal physical signs.

The Wassermann is negative in blood and spinal fluid. The spinal fluid contains no excess of protein or cells. X-ray pictures of the skull show no abnormality.

Cervical Rib: Thrombosis of Subclavian Artery. Contralateral Hemiplegia of Sudden Onset, probably Embolic.

By C. P. Symonds, M.D.

Case I.—L. S., FEMALE, aged 29. Admitted to the National Hospital in 1919, under the care of Dr. James Taylor, for left hemiplegia.

Family history negative.

She had a nervous breakdown with anxiety and depression at the age of 19, and was away from her work (in a drapery business) for three or four months. She quite recovered from this but subsequently complained of pain in the right arm, from the elbow downwards, and weakness of her hand, which made it difficult for her to hold a pen.

In October, 1915, without previous warning, as she got out of bed one morning she fell on the floor feeling helpless on the left side of her body. She did not lose consciousness. She had since been greatly improving.

On examination, she appeared physically and mentally somewhat backward for her age. There was weakness of left face and tongue and upper and lower limbs, with spasticity, increased tendon jerks, absent abdominals and extensor plantar response on that side. The only other abnormalities observed in the nervous system were slight wasting of the intrinsic muscles of the right hand, particularly the thenar eminence, with corresponding weakness, abduction of the thumb being particularly affected.

Above the inner half of the right clavicle there was a visible expansile pulsation; on palpation this appeared to be caused by lifting forward of an artery upon a cervical rib. No pulse could be felt in the right upper limb below this level.

X-ray examination showed a large cervical rib on the right side.

Case II.—I. F., female, aged 20, admitted to hospital in January this year for gangrene of the terminal phalanx of the right index finger and left hemiplegia. Family history of no importance.

The patient was healthy until three years ago; she was accidentally hit by an air-gun pellet in the right hand, the missile entered the first interosseous space and became embedded there. The subsequent symptoms have been attributed by the patient to this injury. The foreign body was removed six months ago.

Two and a half years ago there began to be attacks of extreme pallor, coldness and numbness in the fingers of the right hand, the index, middle, and ring fingers were successively involved. These attacks were excited by raising the hands above the head (as in combing the hair) or by cold; they could be cut short by hanging the arms down by the side of the body or by placing the hand in warm water. Apart from this, there were no pains, weakness, or paræsthesiæ.

In January, 1926, the terminal phalanx of the right index finger gradually became gangrenous and was finally removed.

In May, 1926, she was having tea when she suddenly felt giddy and dropped her cup. She did not lose consciousness. A week later she had another similar attack. The following morning she awoke to find herself completely paralysed on the left side. Together with this she had aphasia. From this she has gradually recovered.

On examination, she is mentally somewhat undeveloped for her age. There is no aphasia. Vision, hearing, smell and taste are normal. Slight left-sided weakness of face, arm, and leg, with spasticity of the limbs, increased tendon-jerks, absent abdominals and extensor plantar response. A cervical rib can be felt on the right side of the neck, the presence of which is confirmed by X-ray examination. No abnormality on the left side. Some pulsation in a vessel just above the right clavicle, which appears small for a subclavian artery (? transverse cervical). No pulsation in the axillary, brachial, or radial arteries on the right side. No wasting or weakness in the right hand, nor any sensory loss, apart from the abnormalities already described; reflexes normal. No signs of general cardio-vascular disease. Wassermann reaction negative.

The interpretation suggested is that pressure of the cervical rib upon the right subclavian artery led to thrombosis, that the thrombus extended backwards to the point of junction with the right common carotid, and that portions of it becoming broken off formed emboli in the terminal branches of the right middle cerebral artery thus finally causing the left hemiplegia.

Descending Lipodystrophy.

By MARJORIE A. BLANDY, M.B.

L. W., FEMALE, aged 38.

History.—Since aged 14 has been "thin," as now.

Family.—Is the fifth of six children. A younger brother, the patient says, "is thin like me."

Condition.—Absence of subcutaneous fat down to the hips. The thighs and legs are quite shapely, although slender. Shows appearance of a double hemiatrophy, but eyelashes persist; surface otherwise glabrous. Scalp hair abundant. Has axillary hair. Absence of normal pigment in facial skin.

Wassermann reaction strongly positive. Has old specific choroiditis. No signs of organic nervous disease. Patient came to hospital on account of rectal prolapse.

50 Symonds—Walshe—Howell

Case for Diagnosis.

By C. P. SYMONDS, M.D. (shown by Dr. BLAKE-PRITCHARD).

C. H., AGED 23, butcher, complains of a series of sudden attacks of muscular weakness of sudden onset, which commenced at the age of six, with gradual deterioration of strength. The weakness is maximal at the beginning of each attack, and gradually diminishes over a space of one or two months. His sister, now aged 31, is a subject of exactly similar attacks.

On examination he shows generalized weakness of all voluntary movements, no structural deformity, no muscular pseudo-hypertrophy but marked lordosis in standing and bilateral ptosis. The electrical reactions of his muscles are normal throughout.

Syringomyelia.

By F. M. R. WALSHE, M.D.

PATIENT, a girl, aged 9 years. At 6 years of age she began to drag her right leg, and it was found on examination that both the right arm and leg were weak. Her condition remained unchanged until February, 1927, when her father noticed that her left arm was " not right " and that her left leg seemed to be dragging a little.

Examination shows *a double spastic paresis* of the *legs* with exaggerated tendon jerks, double ankle clonus, and double extensor responses. Double *main en griffe* with wasting of the thenar and hypothenar eminences and spasticity of both arms. Right limbs more wasted than the left. *Vasomotor paresis in left hand*, which is redder and colder than right. Complete *dissociated anæsthesia* from C5 to C8 on the right and from C3 to C8 on the left. Patient also makes some mistakes with regard to sensation over trunk and legs. Astereognosis in right hand ; pin-prick localization poor all over the right forearm. Slight but *definite lumbo-thoracic curve to left*. No other developmental abnormalities noted.

Birth Injury.

By C. M. HINDS HOWELL, M.D.

" CROSS-BIRTH " delivery without instruments but child very cyanosed.

Icterus neonatorum lasted two to three weeks. Subsequently appeared quite normal until it was noticed that patient made *no effort to maintain himself erect* when made to sit up even at age of 2 to 3 years, and that his limbs were all limp, so that his arms hung down by his side and were rarely moved. At Vincent Square Infants' Hospital nothing was found wrong with patient at this time.

When aged 5 years he could crawl around on the floor but could not support himself upon his legs or for long in a sitting position. When 7 years old he began to attempt to use his legs more, and the movements of his arms, especially of the left, became prominent. Since this age he has walked about alone at intervals but has frequently sustained *injuries from falling, due to spasmodic movements* or contractures of his legs.

Sleeps and eats well, is of a cheerful disposition and very intelligent.

Mother, father, two brothers and a sister all perfectly normal.

Examination.—While asleep the movements cease altogether. Speech interrupted at times and always disjointed. No aphasia or apraxia. Ocular movements : range of movement full to either side but somewhat limited upwards. Masseters and temporals do not harden well. Facial movements are not very extensive and are

ill-sustained. Sterno-mastoids and trapezii weak. Voluntary movements initiated with hesitation. All movements ill-sustained and spasmodic. Constant irregular athetoid movements of the limbs and head. All movements of head and neck weak. Gross ataxy of all movements of arms, which does not increase towards end of movements, and is not affected by visual aid. All arm muscles slightly wasted. Voluntary power of legs weak, especially abduction of thighs, extension of the knees and dorsiflexion of ankles. Gross ataxy of legs. Involuntary movements, chiefly in toes. Increase of tone in legs, very definite wasting of muscles of thighs; tendons of peroneal muscles dislocated from behind on to outer and front aspect of malleoli. Reflexes normal, excepting plantars which give an extensor response. Bilateral talipes equinovarus.

Friedreich's Ataxy.

By C. M. Hinds Howell, M.D.

Female, aged 30. Normal birth. Quite well in every way until aged 11 years when, following a fright, "St. Vitus's Dance" developed. From this time she began to stagger when walking.

Between 11 and 13 years of age she continued at school and attained a normal standard (VI). Her walking became gradually worse, so that by the age of 21 she could not walk at all. Between 13 and 21 years of age both arms became weak and clumsy, so that she has been unable to feed herself. She has been in the Town Hospital, Guernsey, for eight years.

No pains or paræsthesiæ, acute illness or visual disturbance at any time. Menses normal. Since admission to the National Hospital her legs have become stronger, the choreiform movements of the arms have lessened and her general health has improved.

Patient adipose and childish. Choreiform movements of face and hands. Irregularity of eye movements and weakness of right lower face; cranial nerves otherwise normal. Motor: coarse choreiform movements, hypertonia of arms, ataxy of arms, dysdiadokokinesia, "cerebellar rebound" of arms, no deformity of feet, no spinal deformity. No tendon reflexes. No abdominal reflexes, plantar reflexes ? extensor right. No impairment of sensory system.

A Case of Tower Skull.

By J. S. Collier, M.D.

Patient, a female, aged 36, was born after a normal confinement and delivery with a cranial deformity, which has since become progressively more noticeable. Until two years ago (1924) she was in other ways as normal as at birth, i.e., she had no useful vision with the right eye and was slightly deaf in both ears, worse with the right. Otherwise she has led an active life and with the aid of glasses (worn since the age of 3 years) has been able to look after herself and read even the smallest type.

Two years ago both her sight and hearing began to deteriorate and since then have steadily become worse.

Makes no complaint of headaches; vision and hearing have never been otherwise disturbed.

52 Collier: *Tower Skull;* Walshe: *Olivo-ponto-cerebellar Atrophy*

Family.—One brother died as an infant having an exactly similar skull. One (paternal) cousin is now living, and although he has a similarly shaped head the deformity is only slight and he is not blind or deaf. Her (paternal) grandmother was delivered of two children who died in infancy, both with "hydrocephalus."

Examination reveals a gross deformity of the skull with dislocation of the orbital content and cranial nerve distribution. She is now under treatment for a recent attack of acute anterior poliomyelitis.

Olivo-ponto-cerebellar Atrophy.

By F. M. R. WALSHE, M.D. (shown by Dr. WILKINSON).

PATIENT, male, aged 67, gives a history extending over the past five years of difficulty in speaking, occasional causeless vomiting, shakiness of the legs, and inability to perform finer hand movements. For the last two and a half years he has also been "muddled in his head."

Family and past history *nil ad rem.* Patient denies having had venereal disease and his Wassermann reaction is negative.

There are constant pseudo-athetoid movements of the fingers when the arms are outstretched, best seen in the left arm. Co-ordination much impaired. All movements are carried out stiffly, jerkily and irregular, and there is some loss of power in flexion and extension of both elbow-joints. This is also true of the knee-joints and there is marked inco-ordination in the heel-knee test. Tonus of the limbs normal. Sense of passive movement impaired in the feet and toes of both sides. No other definite sensory loss.

Right pupil slightly larger than left; both react poorly to light and convergence. No nystagmus and no diplopia. R.V.A. $\frac{6}{12}$ partly. L.V.A. $\frac{6}{18}$ partly.

Marked overaction of all the facial musculature, best seen in raising the eyebrows.

Some ? Rombergism; gait shows a gross amount of swaying and lurching indifferently to either side.

Cardiovascular, pulmonary and alimentary systems normal. Blood-pressure 134/100.

Section of Obstetrics and Gynæcology.

President—Dr. ARCHIBALD DONALD.

Communication on Necrosis of the Cortex of the Kidney after Labour.

By ARTHUR CROOK, L.R.C.P.Lond., M.R.C.S.Eng.

NECROSIS of the cortex of the kidney is, according to Sir Humphry Rolleston [1], extremely rare. In his article in the *Lancet* (October, 1913) [1], eleven cases are tabulated, the only ones reported up to that date. I have since then found published seven others, making eighteen in all, not including one of my own, as yet unpublished.

I have not included any case in which there has not been a microscopical examination either of the kidney after death or of a portion removed at the operation of decapsulation during life.

At the outset it must be recognized that the condition is not absolutely limited to cases in which there have been pregnancy and labour; a condition said to be similar, including the symmetry, has been found in cases of corrosive sublimate poisoning (Heineke [24]), scarlet fever (Juhel Rénoy [21]), diphtheria (Stoeckenius [25]), pneumonia (Herzog [14]), peritonitis (Herzog [14]), and carcinoma of stomach (Herzog [14]). In this last instance the left kidney only was involved—a unique occurrence in this condition, I believe.

The pathological changes indicating this peculiar condition are :—

(*a*) *Areas of necrosis* (in some cases almost complete necrosis) in the cortex of the kidney.

(*b*) *Thrombosis of renal vessels*, mostly the intralobular vessels in the middle zone. This thrombosis has been found in the capillaries only, in one case (Jardine and Kennedy's) : in the intralobular arteries only, in twelve cases (Rolleston six—my series, six); in veins only, in one case (Torrens); in intralobular arteries and veins in five cases (Rolleston four, my series, one).

(*c*) A narrow, apparently *comparatively healthy zone of tissue* under the capsule of the kidneys, found microscopically to show *dilated vessels with cell proliferation* but no necrosis, the latter being present and most marked in the tissue next to the narrow zone. This was found in at least eleven out of the eighteen cases.

(*d*) Signs of *pre-existent renal disease* are found in about half the cases.

(*e*) *The lesions were symmetrical in arrangement* in most of the cases.

Glynn (Glynn and Briggs [9], *Journal Path. and Bact.*, 1915, xix) describes very fully in one case the pathological conditions found after death; he records œdema in the muscle coat of the small intestines, in the stomach, and in a mesenteric gland. He discusses the cause and structure of the thrombi, which he regards as originating from blood-platelets, not corpuscles, and records that the liver showed slight signs of pregnancy toxæmia.

Jardine and Kennedy [10] (*Lancet*, 1920 (ii), 116) report one case, and deal fully with suppression of urine after labour; pointing out that suppression is not always associated with cortical necrosis, but may occur in cases of chronic nephritis with pregnancy.

These authors appear to think that there are signs of pregnancy toxæmia in all cases of cortical necrosis, whether or not there is pre-existent renal disease, and they deprecate the operation of decapsulation, except perhaps when there is chronic nephritis in addition, while admitting the practical impossibility of differentiating between these two classes of case.

Cruickshank [11] (*Journ. Obst. and Gynæc. Brit. Empire*, 1923) describes one case of which the clinical history strongly indicates the existence for about eight years of chronic renal disease; at the post-mortem was found the unique feature of considerable blocking of the left ureter, due to large cheese-like plugs of necrotic material. Some observers have called attention to the similarity between the uræmic signs in these cases and those seen in calculous obstruction of the ureters, and their difference from the classic uræmic signs. Thus Griffith

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and Herringham speak of the "calm" uræmia of calculous obstruction (as distinct from the "stormy" uræmia of chronic renal disease), the former being present in their cases.

The other pathological findings in Cruickshank's case, however, are generally in keeping with the rest of the series.

In foreign literature I find G. Geipel [12] records two cases; G. Herzog [14] one case; and A. Schüppel [15] one case. Geipel mentions a case reported by von Zanegar, but gives no reference. Herzog speaks of a case reported by Beneke [16], the only accessible details of which are the following: (1) The patient died ten days after delivery, with eclampsia; (2) necrotic areas were found with thrombi in the arteries; and (3) the condition was thought to be due to infarcts. These scanty details are not sufficient, in my opinion, to justify the inclusion of the record in my series.

In Geipel's first case no eclamptic symptoms were noticed, the suppression having lasted four and a half days. Headache and vomiting were the prominent symptoms; and there was albuminuric retinitis.

In his second case there were necrotic foci in the spleen and suppression of urine was complete up to four and a half days. On the seventh day, when the excretion of urine had become abundant, the patient died. Geipel is inclined to explain the changes found in the kidney as "regenerative," and thinks that the evidence from cases of sublimate poisoning in which cortical necrosis is seen supports this theory. Herzog disagrees with this, and regards the changes as forerunners of infarction, while Schüppel is against the embolic theory. Geipel holds that necrosis of the renal cortex and other forms of eclampsia usually occur in patients with no previous renal disease. He holds also (as against Herzog's view) that the thrombi commence in the larger arteries and proceed to the periphery, while Glynn and Briggs think that the thrombosis is primarily distal in origin.

The only case in which a chemical examination of the blood is reported is that of Griffith and Herringham. It is as follows: (*a*) The chlorides were normal; (*b*) the phosphates and urea were enormously increased; (*c*) the sodium was decreased; (*d*) the potassium was increased.

In my case the blood-urea was as high as 388 mgm. The blood-sugar was within normal ranges.

In all the reported cases (18) the patients died, and the reports on the renal changes found are from post-mortem specimens. The case I shall report is the only one in which, as far as I can trace, the patient has survived necrosis of the cortex of the kidney. It may be noted that decapsulation of the kidney was carried out.

But it must be added that in two cases of cortical necrosis with anuria recorded in Jardine and Kennedy's paper, and in Glynn's and Cruickshank's cases, the patients all died, notwithstanding decapsulation (in two of the cases of both kidneys). Two of the cases ended fatally within a few hours. Decapsulation in my case was performed ninety hours after labour, as the blood-urea was steadily rising.

The only other English report I can find on portions of kidneys removed during operation is one by Mr. Clifford White [17] (*Proc. Roy. Soc. Med.*, 1919 [Sect. Obstet. and Gynæc.]), on sections from two cases, one with eclampsia, the other probably without, both suffering from suppression, and both having recovered.

M. Gérard [18] (France) quotes three reports on specimens removed at operation and speaks of "islets of epithelial nephritis" and of "acute nephritis" of "diapedetic form." He also mentions "strangling" of the kidney in its capsule.

Commenting upon the cases in his paper, Rolleston deals mainly with four points. I propose briefly to discuss these fresh cases under similar headings to indicate how far they support or differ from Rolleston's conclusions.

(1) *Presence or Absence of Uræmic Symptoms.*—Rolleston concludes that in at least seven of his eleven cases there were symptoms which could be classified as uræmic.

Of the additional seven cases six showed uræmic signs. And as in my case there were vomiting, headache and epistaxis, the condition of all the cases may be regarded as confirming Rolleston's finding.

In three cases the systolic blood-pressure is stated. In Lloyd's case the highest was

188 mm., the lowest 120 mm. In Rolleston's case it was 115 mm. In Torrens' case the pulse tension is given as "not high." In Cruickshank's it was 145 mm. after labour. In my case the highest reading was 120 mm., and the lowest 95 mm.

(2) *The Relation of Old-standing Renal Disease to the Occurrence of Convulsions.*—Rolleston finds in his eleven cases some evidence that pre-existent renal changes favour the occurrence of convulsions. The fresh cases go no further towards proving a definite relation between an old nephritis and eclampsia than is disclosed in his series alone. It must be concluded that there is as yet no evidence either way.

Thus, Jardine and Kennedy (1920) reported fits in all three cases in which there had been previously existing renal lesions as well as cortical necrosis. Of the three cases with no previous disease only one had convulsions, and of the three cases (Glynn and Briggs, Jardine and Kennedy, and Cruickshank) with old renal changes, only one had fits. In Herzog's case, with slight old renal changes, fits occurred, and in Geipel's case with fits no old changes were noticed; in his case without fits old changes were obviously present.

(3) *Suppression of Urine.*—This varied considerably in extent in the first series of cases; and was rarely quite absolute. In one case (Klotz's) 16 oz. were passed on the day before death. In Schüppel's case only 10 c.c. were passed in two and a half days. In Herzog's case there was complete suppression for the last two days; but 30 c.c. were passed in the previous two days. In Geipel's first case suppression was complete. In my case roughly 20 oz. in ninety hours were passed before decapsulation. This variability of anuria is in keeping with Rolleston's reports.

(4) *The Cause of the Thrombosis.*—Rolleston concludes that this is due to pregnancy toxæmia, and thinks that it may combine with the toxæmia to *produce* complete necrosis of the cortex and degeneration of the tubules. Jardine and Kennedy find no explanation of the thrombosis. Kennedy concludes that the thrombosis follows *after* the necrosis and notes, in a case of anuria of only two days' duration, no thrombosis in the veins but only in the capillaries. Cruickshank thinks that the necrosis is secondary to the thrombosis. On the whole these additional cases throw no fresh light on the cause of the thrombosis.

No thrombosis was found in the two cases recorded by Clifford White; this led him to suggest that it and the cortical necrosis were terminal phenomena only, and not the actual cause of suppression. The specimen from my case, however, shows that cortical necrosis may be present, and recovery, nevertheless, take place.

If thrombosis is present before necrosis, as Cruickshank concludes after careful examination of the evidence, it may have been present in my case; but it is not seen in the section shown.

In attempting to explain this absence of thrombosis, it may be noted that in one of Jardine's cases it was found only in the capillaries, and in that instance anuria lasted only two days; it is therefore possible that in my case thrombosis even of the capillaries had not yet occurred, the necrosis being the primary lesion. Perhaps a more obvious explanation is that the whole kidney was not available, as it would have been in a post-mortem, for cutting enough sections to include an intralobular vessel. This of course applies equally to Clifford White's specimens.

In the two cases in Clifford White's paper, in which tissue was examined after removal in operation, the tubules are reported as "dilated." This statement is not, however, found in any reports on post-mortem specimens, in which possibly intracapsular pressure had fallen after death. If this dilatation is peculiar to living specimens, it might be considered evidence of abnormal intratubular pressure. On the other hand, there is evidence suggesting that it is due to old disease not necessarily connected with the fatal illness. In one case (Laurence and Bradford's) [2], in which endarteritis occurred, the glomeruli are recorded as "enlarged." And in two cases

with chronic nephritis only, reported in Jardine and Kennedy's paper, the tubules showed dilatation. In Glynn's case the tubules showed cystic dilatation and the condition of the kidneys is reported as that of chronic nephritis before acute necrosis occurred. There does not appear to be dilatation of the tubules in my specimen.

Whether or not the point is of importance is not yet certain, for it has been stated by T. G. Brodie [19], of Toronto (*Lancet*, September 13, 1919), that dilatation of the tubules is found in the kidneys of normal dogs removed during life (if rapidly examined) during active diuresis.

Rolleston states that œdema never results from cortical necrosis alone; it is always due to the presence of other renal disease. I cannot trace the evidence on which he relied in his eleven cases. In Jardine's three cases œdema was present, but the pathological reports state that the kidneys were previously healthy, and in Torrens' case there was œdema of the ankles but no previous renal mischief. In Geipel's second case there was no pre-existent disease but œdema of the face and legs. In my case, though the absence of renal mischief previous to the pregnancy cannot be definitely established, the œdema of the legs was extreme. The patient up to now (after twelve months) is in good health.

As regards other organs in cases of cortical necrosis, in Herzog's case the liver is reported as pale in colour. In Geipel's second case necrotic foci occurred in the spleen. Jardine and Kennedy found hæmorrhagic foci in the pons in one case; in three cases foci were found in the liver, and in one case in the intestines and in the suprarenal glands. In five of Jardine's six cases focal necrotic areas were found in other organs, and as in the sixth case no examination was made of any organ except the kidney, he concludes that the condition is the same as that of eclampsia.

The close connexion, in some cases, between eclampsia and cortical necrosis cannot be doubted, but it is impossible in the face of the reports of Geipel (second case), Cruickshank, Glynn and Briggs, and Torrens, to consider the two conditions identical.

The question of the presence of bacterial infection is dealt with in five cases only. In Lloyd's case *no micro-organisms* were found in the kidneys. In Herzog's case *no cultures* could be obtained. In Rolleston's case a streptococcus was cultivated from the spleen, in association with the *Bacillus coli*. In Cruickshank's case the uterus was stated to be *septic* except at the fundus. In Torrens' case the contents of the uterus were described as "decomposing clot"—but the thrombi did not "appear" septic. I quote the exact words used. In Glynn and Briggs' case spirochætes were searched for but not found. In my case there was no sign of infection till after the catheterization of the bladder, twenty-four hours after labour, when purulent cystitis developed. Consideration of all the cases does not give the impression of a condition resulting from primary bacterial infection.

In all recorded cases the fœtus was dead except in one (Jardine and Kennedy, Case II), in which twins at the eighth month were born alive, and in all cases labour was premature, though to a very varying degree.

While decapsulation of the kidney can hardly have any immediate effect on uræmia, it is possible that it causes simple physical lowering of the intracapsular tension of the kidney, which may enable excretion of water as distinct from other substances to take place. This is borne out by the fact that in some cases of decapsulation, and in at least one case in which decapsulation was not performed, excretion of low specific gravity urine was rapidly established before death, though it was some time before an appreciable amount of urea was excreted by the kidney; in one case (mine) the blood-urea actually continued to rise for at least four days after the operation. In Geipel's second case, in which the kidney was not decapsulated,

the excretion of urine on the seventh day of the puerperium is described as "abundant"; œdema was still present, there was Cheyne-Stokes respiration, and the patient died that day.

It is perhaps important that the first symptom in the history of some of the patients was a retention of fluid, shown by œdema of the legs, before there was evidence of nephritis. This is noted in a case quoted by Jardine and Kennedy in which there was no decapsulation of the kidney and the patient recovered; it is therefore not certain whether that case was one of cortical necrosis or of nephritis only. A guarded suggestion might be made that *some* toxic pregnancies are *initiated* by retention of *water only* in the body. Such retention of fluid may be possible, even before obvious signs, such as swelling of legs, etc., are seen, as shown by Glynn's observation of the state of the muscular coat of the stomach and intestine; by Cruickshank's case, in which there was œdema of spleen and pancreas; and by Herzog's case with œdema of the ovary, hydrothorax and ascites.

Theoretical Considerations.

Assuming that a pregnancy becomes toxic when there is interference with the metabolism and elimination of water only, it might follow that the varied clinical pictures seen in the "symptom-complex" of toxic pregnancy are due to: (1) the extent of this interference; (2) the effect of the interference on other metabolic processes.

There is no need to postulate the presence of a "special toxin" or of a bacterial infection, or of partial separation of the placenta as primary causes in these cases of pregnancy toxæmia. The difficulty is to assign a reason for this interference with water elimination. This might be helped by grouping the following ideas:—

(1) The association of the pituitary gland with growth and with the excretion and elimination of water (Sharpey-Schafer [22]).

Here, Moletor and Pick's experiments (quoted by Sharpey-Schafer) [22], are most significant. They show that the toxic effect of administering large quantities of water to animals (pituitary extract having previously been given to delay excretion) can be removed by giving them urea. They hold that one of the main functions of the pituitary is to determine the amount of water the tissues can hold.

(2) The clinical observation of signs, in some pregnancies, similar to acromegaly.

(3) The evidence (not yet complete but gradually accumulating) of the relation between the internal secretory glands (especially the pituitary) and metabolic processes and the effect of pregnancy on these glandular activities.

(4) No condition exactly similar to toxic pregnancy is known to exist in animals.

To this last statement should be added the following:—

(*a*) "Milk fever" has occurred before parturition, and albumin and casts and sugar have been found in the urine (Mamadyschky [28]). The frequency of "milk fever" increases with departure from natural wild conditions, i.e., with improved breeding (Fleming [26]).

(*b*) Toxic cases, said to occur in sheep and cattle, are associated with very fatty livers, the blood calcium being low (L. P. Pugh [26]).

(*c*) Eclampsia in bitches is similar to acute parathyroid deficiency, but albumin is not present in the urine. (Hutyra and Marek [27]).

(*d*) Zundel considers that albuminuria is a normal accompaniment of gestation in animals. Hering [28], Franck [28], and Simader [28], also found it. If this is confirmed it may show that animal endocrine conditions can support a renal insufficiency in pregnancy which the human endocrine conditions cannot.

Perhaps one may carry on the theory and suggest that the process of evolution

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in the human subject has modified some of these glandular organs, and that the pituitary gland, for one, has, in gaining new functions, been hampered in others.

In making these speculations I wish only to stimulate interest in the investigation of the water balance of the body (L. G. Rowntree [20]), in pregnancy, especially in normal pregnancies, in order first to fix a standard, and then to compare it with toxic pregnancies. Such investigation, I think, would be fruitful.

Full Clinical History of Author's Case.

A married primipara, aged 29, first seen at the eighteenth week of gestation, for pain in the right lower abdomen, which soon subsided, and for which no cause was discovered, her urine and physical condition being apparently normal. Both her mother and a cousin had had albuminuria and eclampsia, her sister had died from diabetes at the age of 20. The patient herself had had scarlet fever.

There had been no vomiting during the pregnancy, but some heartburn. At the twenty-seventh week the patient had a slight vaginal hæmorrhage: urine then normal, systolic blood-pressure 120 mm.

At the thirty-first week she reported that her legs were swollen; the urine contained no albumin, but 2 gr. of glucose per oz. and small quantities of diacetic acid and acetone were present. The patient was advised to take no salt in her food.

At the thirty-third week the legs were more swollen, there was no albumin in the urine, glucose being present only in urine collected after taking food; acetone and diacetic acid were not now found.

At the thirty-fourth week the patient had premature labour, terminating in twelve hours with the birth of a dead child. One-eighth of a grain of morphia and $\frac{1}{300}$ gr. of hyoscine, a small quantity of chloroform, and some A.C.E. mixture were given during labour, the forceps was applied to the head at the perineum after two doses each of $\frac{1}{4}$ c.c. of pituitrin had failed to produce expulsion of the child, the patient being very restless and unreasonable.

The third stage was normal. The perineum had to be sutured.

First day.—Twenty hours after termination of labour the nurse reported that the patient had not passed any urine, and a catheter passed produced only 2 drm., which were found to be loaded with albumin. The patient vomited frequently a coffee-coloured fluid (thought then to be anæsthetic vomiting); imperial drink, in which glucose was dissolved, was given. Temperature, pulse and respiration normal.

Second day.—Patient again vomited brown fluid; no urine passed.

Third day.—Temperature, pulse and respiration normal, but no urine passed; 5 oz. obtained by catheter contained a small quantity of albumin, a trace of acetone, no diacetic acid. Systolic blood-pressure, 120 mm. Patient had a sharp attack of epistaxis; blood-urea, 212 mgm. per 100 c.c. of blood; 18 oz. of saline were given under the skin.

Fourth day.—5 oz. of urine passed and 10 oz. removed by catheter; bladder washed out with boric lotion, as pus was present in the urine, the odour of the urine being very offensive. Blood-urea, 258 mgm.; 2 pints of glucose saline were injected into right median basilic vein.

Fifth day.—Blood-urea, 310 mgm.; no urine passed; decapsulation of right kidney performed at 5 p.m. by Sir Hamilton Ballance, at my request.

Sixth day.—A total of 33 oz. of urine was passed, alkaline in reaction with a trace of albumin present, specific gravity 1012, $2\frac{1}{2}$ gr. urea per ounce. Temperature, pulse and respiration normal.

Seventh day.—Total urine passed, 79 oz.; urea per ounce, 3 gr., a more noticeable trace of albumin present; blood-urea, 354 mgm.; temperature 100·6° F.; pulse 100. Some dullness of left side of chest and bronchial wheezes at the right side. Œdema of the legs still present and some œdema of the right arm. A papular rash on arms and legs. The patient was put in the upright position in bed for twelve hours and oxygen administered.

Eighth day.—Blood-urea 388 mgm. Total urine 57 oz. Urea $3\frac{3}{4}$ gr. per ounce; no dullness of the right chest now, but some at the base of the left; also œdema of the loins.

Ninth day.—Blood-urea 372 mgm. Nurse reported occasional twitching of left side of face and hand, and that patient seemed more sleepy. Pulse 108, temperature 100·6° F. Glucose present in the urine. Three pints of glucose saline given in left basilic vein.

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Fig. 1.

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From a water-coloured drawing of the section of kidney mounted for microscopical examination, fixed in 5 per cent. formalin stained with Ehrlich's acid hæmatoxylin and Biebrich's scarlet. The areas of necrosis stained pink, the comparatively healthy tissue blue. (x 8 diameter).

Tenth day.—Slight epistaxis. Temperature 100·6° F., pulse 112; respiration as low as 14, never higher than 20.

Eleventh day.—Systolic blood-pressure 95 mm.

Twelfth day.—Patient complained of seeing colours, which deranged her vision.

Fourteenth day.—Patient complained of salt taste in her mouth. (This symptom lasted well into convalescence.)

Seven weeks after labour.—A slight trace of albumin in the urine. A urea-concentration test gave: First hour, 1·2 per cent.; second hour, 1·6 per cent.; third hour, 1·65 per cent.

Seventeen weeks after labour.—Renal concentration test gave: First hour, 1·3 per cent.; second hour, 1·1 per cent.; third hour, 1·3 per cent. Patient complained of stiffness of muscles and slight œdema of feet at night.

Twenty-five weeks after labour.—Blood-urea, 37 mgm.; urea concentration test gave the following: First hour, 2 per cent.; second hour, 2·6 per cent; third hour, 2·99 per cent. Minute trace of albumin in the urine, possibly due to the slight cystitis still present, there being a small quantity of pus in all specimens, resulting from a coli infection. Otherwise the patient is now in good health.

Treatment.

In addition to decapsulation of the kidney the patient received the following routine treatment: administration of hot imperial drink, and of acetate of ammonia, application of hot packs to the skin, ingestion of saline subcutaneously, and of glucose saline intravenously.

The Glycosuria.

This was detected at the twenty-fourth week of pregnancy, when the œdema of the legs first appeared. It was again present at the ninth day of the puerperium (no test for it was made between the fourth and ninth day); it varied from a trace to as much as 7 gr. per ounce, and at times amounted to 400 gr. per day. There was just a trace at the end of the third week, and only then did the slight mammary changes (a little swelling and tenderness of right breast) occur, subsiding in two days. The sugar again increased up to 1 gr. per ounce, again subsiding to a trace, and disappearing in three months.

The blood-sugar was estimated three times. On the second day after labour, 0·117 per cent.: and the fourth day, 0·09 per cent.; and on the twenty-second day, 0·131 per cent. (This last amount was coincident with the mammary changes, and perhaps related to them.)

I am indebted to Dr. D. Brough, Assistant Pathologist to the Norfolk and Norwich Hospital, for the following report.

Microscopical Report on the Sections.

The principal lesion present is focal necrosis. Two such foci are present in the sections cut, each occupying rather less than one low-power field of the microscope. In the necrotic tubules the general outline of such is maintained, but nuclear staining is abolished and the individual cells can no longer be distinguished. There are no lumina here, either they are filled with débris or a solid necrotic mass replaces the original tubule. One totally necrosed glomerulus is seen, the outline of the tuft being still visible. It shows much polymorphonuclear infiltration, especially at the attachment of the tuft and, a great deal of polymorphonuclear débris. The stroma in the two areas is not necrosed, but is the seat of much polymorphonuclear infiltration and contains again much nuclear débris. In relation to the necrotic foci there are several (? collecting) tubules in which the epithelial cells are large and active-looking with hyperchromatic nuclei. In relation to the foci also, but present as well in other parts of the section, there are aggregations of intensely engorged capillaries.

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Apart from the focal lesions the chief changes in the kidney are as follows :—

(1) Undue cellularity of many glomerular tufts and the presence in many of them of polymorphonuclear leucocytes, and nuclear débris.

(2) The presence of blood in one or two of the Bowman's capsules.

(3) The presence of many desquamated epithelial cells in some of the convoluted tubules and that of blood, hyaline casts and débris in others.

Everywhere there is a considerable excess of polymorphonuclear leucocytes—in the stroma, the glomeruli, and less frequently in the tubules.

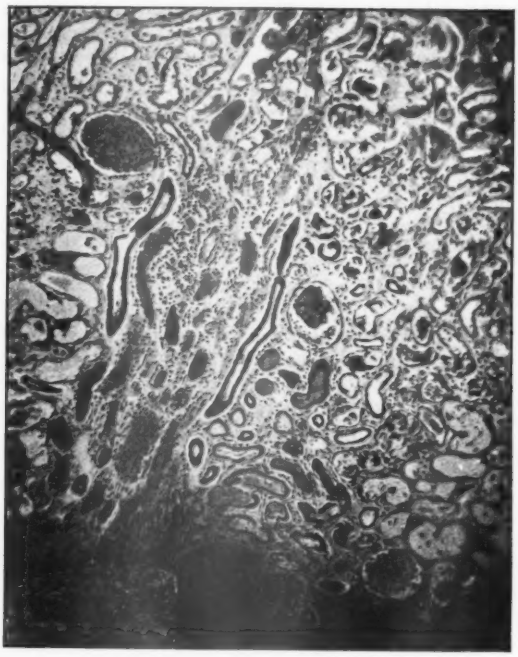

FIG. 2.—Photomicrograph × 70. The two collecting tubules with hyperchromatic nuclei are here shown (see text of Report). The area of necrosis lies immediately below these tubules and is seen in fig. 3.

(This photomicrograph should be examined with a magnifying glass.)

The lesion is evidently a fairly acute one, but had probably been in existence for some days (possibly one or two weeks) to judge by the appearance of the necrosed tubules and the evidence of proliferation. The polymorphic infiltration and the focal necrosis suggest an acute intoxication, bacterial or otherwise.

The facts in this case which differ from most of the others published are :—

(1) The absence of a high blood-pressure—it was 95 mm. two days after a blood-urea estimation of 372 mgm.

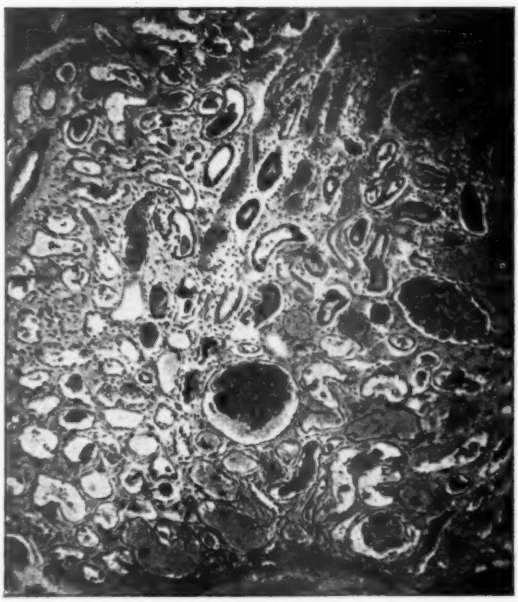

FIG. 3.—Photomicrograph × 70. Shows actual area of necrosis—necrosed glomerulus in the upper right hand corner, many necrotic tubules devoid of nuclear staining and a Malpighian corpuscle with blood inside Bowman's capsule.

(This photomicrograph should be examined with a magnifying glass.)

(2) The very high blood-urea found without convulsions—and yet recovery took place. It was 388 mgm. on the eighth day.

(3) The absence of any sign of severe toxæmia before labour, only œdema and glycosuria being present.

(4) The recovery notwithstanding the extensive necrosis in the kidney.

CONCLUSIONS.

(1) Necrosis of the cortex of the kidney after pregnancy may occur, with recovery of the patient.

(2) It may, or may not be, associated with previous renal disease—in at least a third of the cases it certainly was.

(3) The pathological changes found are fairly uniform in all the reported cases, the leading features being thrombosis of interlobular arteries, necrosis in areas of the cortex, and, in many of the cases, necrotic areas in other organs.

(4) A similar pathological condition has been seen in conditions unassociated with pregnancy.

(5) The cause of the thrombosis, and its relation to the necrosis, are unknown.

(6) Opinions as to whether the thrombosis or the necrosis is the first lesion are about equally balanced.

(7) Consideration of these cases of cortical necrosis with suppression of urine in relation to toxæmia of pregnancy suggests a relation between the latter and the water metabolism of the body.

TABLE OF REPORTED CASES OF CORTICAL NECROSIS OF THE KIDNEY WITH PREGNANCY.

Ref. No.	Author	Parity	Age	Duration of anuria	Uræmic signs	Pathological findings plus necrosis	Signs of previous disease
2	Bradford and Laurence	7	36	7 days... ...	Absent	Endarteritis, interlobular arteries	No fibrosis
3	Griffith and Herringham	Multi.	35	6 days... ...	Almost absent ...	Chronic nephritis-retino-papillitis	Present
4	Lloyd...	Multi.	39	11 oz. in 11 days	Fits after delivery ...	Chronic interstitial nephritis	Present
5	Jardine and Teacher (Case 2)	?	22	9 oz. in 7 days...	Fits before delivery ...	Very slight endarteritis only	?
6	Klotz	1	25	Not complete ...	Two fits after delivery, dyspnœa	Some old changes	Present
7	Jardine and Kennedy ...	2	23	1½ days ...	Fits before delivery ...	Scanty thrombosis in arteries and capillaries ...	None
	Jardine and Kennedy ...	9	34	4½ days ...	Dyspnœa only ...	No old changes	None
	Jardine and Kennedy ...	2	36	2½ days ...	Vomiting, one fit ...	No old changes	None
5	Jardine and Teacher (Case 1)	7	36	5½ days ...	Fits before and after delivery	Slight subacute interstitial nephritis	Probably
1	Rolleston	14	48	8 days ...	Dyspnœa and twitching	Thrombosis renal and ovarian veins	None
8	Torrens	2	20	4 days ...	Cheyne-Stokes respiration	Thrombosis renal veins	None
9	Glynn and Briggs ...	0	29	8 days ...	Dyspnœa and coma ...	Thrombosis arteries and veins	Probably
10	Jardine and Kennedy ...	7	48	5½ days ...	Fits, œdema of face ...	Thrombosis interlobular arteries	Present
11	Cruickshank	10	30	5 days complete	Dyspnœa, vomiting ...	Thrombosis arterioles	Slight
12	Geipel	3	32	4½ days ...	Vomiting, stupor, retinitis	Thrombosis interlobular arteries	Present
13	Geipel	2	35	4 days ...	Cheyne-Stokes respiration, one fit	Thrombosis interlobular arteries	None
14	Herzog	?	22	2 days ...	Vomiting, coma, fits	Thrombosis interlobular arteries	Slight
15	Schüppel	?	35	2½ days ...	Fits, coma	Thrombi and necrosis...	Not stated
	Crook...	0	29	3½ days ...	Slight twitching and vomiting, epistaxis	Areas of necrosis of cortex	—

The first eleven cases were reported by Sir Humphry Rolleston.

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I have to express my thanks to Dr. Dorothy Staley for her valuable help in searching, abstracting and translating the foreign literature on the subject. Also to Mr. L. P. Pugh, F.R.C.V.S., Hon. Secretary to the Section of Comparative Medicine of this Society, for his help, and information as to the conditions in animals.

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Discussion.—Mr. CLIFFORD WHITE said that his two cases to which Mr. Crook had referred were published as an early stage of the condition that later became one of cortical necrosis. He had not had an opportunity of incising the kidney cortex since then, but he had seen two cases that came into the class under discussion. The first was admitted to a medical ward as a case of mercurial poisoning with suppression of urine following an intra-uterine douche of perchloride of mercury after delivery. She had no marked symptoms except complete suppression, which continued till she died. Uræmic symptoms were not present. The physician in charge would not permit a nephrotomy to be done.

The second case was that of a patient who had had one early miscarriage but no children. She was thirty-five weeks pregnant, and four days after a transient febrile attack she noticed that she was passing very little water. The next day, April 5, 1922, a catheter passed at 10 a.m. produced only 1 drm. of brown purulent urine. In the next twelve hours only ½ drm. was obtained. Vomiting was severe but there was neither œdema nor convulsions. Pulse 150 and poor quality. At 2 a.m., April 6, Cæsarean section was done under spinal anæsthesia and a macerated fœtus removed. Palpation of the kidneys through the high Cæsarean incision showed the left kidney to be very hard but not absolutely stony. The right kidney was of normal consistence. This was the only case in which he had found the two kidneys different in consistence on palpation. Neither was incised as the patient was extremely ill on the table, and also it was feared that coli bacilli would escape from the kidney into the peritoneal cavity as the urine had contained pus. No urine was passed on April 6, but the next day 2 oz. containing 0·75 per cent. urea were obtained. No casts were present, but a few coli bacilli were seen. She died on April 10, having passed over 11 oz. on that day.

The third case he would record was one under the care of Mr. Miles Phillips, of Sheffield, who had kindly supplied the notes as he was unable to wait for the discussion. The patient was a primipara. There had been no previous albuminuria, but during the second stage of labour she had a single convulsion. A catheter specimen then showed almost pure blood. After delivery only 4 to 8 drm. of bloody urine were passed each day. On the fourth day the right kidney was exposed in the loin and the capsule was split longitudinally. The kidney was plum-coloured and stony-hard. There was a great increase of urine within thirty-six hours, and after forty-eight hours she passed four pints daily. She made a perfect recovery. No portion of the kidney was removed for examination, so it was impossible to state whether dilatation of the tubules was present as in the two previously recorded nephrotomies.

He (Mr. White) pointed out that he had advocated incision of the capsule to relieve the tension inside it. This could be done at any time through an incision in the loin or through

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the high Cæsarean incision at the same time as a Cæsarean section. One or two writers had referred to his two cases as having had the kidney "decapsulated." This was not correct. "Decapsulation," as he understood it, was the operation advocated by Edebohls and performed chiefly in cases of chronic nephritis and mainly with the idea of obtaining an accessory circulation through adhesions to the cortex. Such an intention would be wrong in the case of an acute condition like puerperal anuria.

Professor MUNRO KERR said that the essential question was whether the condition was a distinct entity or simply a variation of the severe destructive effects of pronounced toxæmia.

He referred to the recent work of Dr. Cruickshank, Royal Maternity Hospital of Glasgow, who appeared to be satisfied that the condition was not an ordinary necrosis comparable with the necrosis in liver and other organs commonly found, but was a primary thrombosis possibly associated with a spasm of the terminal arteries. He was of opinion that the condition was probably superimposed on a chronic lesion, as he had invariably found evidence of old chronic mischief in some part of the kidneys. Certainly, as regarded clinical features, the disease did present certain peculiarities, e.g., it was much more common in multiparæ. In Cruickshank's case recorded in 1923 the patient was a 10-para; and in Mr. Crook's table 70 or 80 per cent. of the cases were seen to occur in multiparæ. Mr. Crook's own case, in which a portion of the kidney had been removed at the decapsulation, was particularly interesting. But the amount of tissue removed and examined hardly justified the conclusion that there was no pre-existing chronic lesion elsewhere.

Mr. Clifford White's successes from simple incision of the renal capsule were striking. One would expect that this was just the type of kidney lesion to derive benefit from such treatment.

Dr J. BAMFORTH said that Mr. Crook's case raised the question whether nephritis with necrosis and symmetrical cortical necrosis of the kidneys were two distinct conditions or whether the former condition was an early stage in the pathological process which eventually led to the classical picture of massive cortical necrosis. Various authors had expressed the opinion that thrombosis of the interlobular arteries was the primary lesion in the kidneys in cortical necrosis, but Mr. Crook's case, which showed definite areas of necrosis without evidence of thrombosis, would suggest the possibility that the necrosis of the renal epithelium was the first change. In a case occurring in an adult man, which he (Dr. Bamforth) had published in 1923, and in which almost the whole of the cortex of each kidney was involved, fibrinous thrombi were present in the glomeruli and in their afferent and efferent arteries, also in some of the cortical veins. But no thrombosis of the interlobular arteries was established. In another case which he had had the opportunity of examining and in which also almost the whole of both cortices was involved the maximum effect was produced in the middle zone of the cortex and not in the outer zone as would have been expected if the primary lesion had been in the interlobular arteries. It was possible that the fibrinous thrombi found in the smaller vessels might have arisen secondarily from their close contiguity to the damaged renal epithelium. The large percentage of cases in which lesions had been found in organs other than the kidneys, indicated that the process was general and due to an altered state of the blood, infective or otherwise, and that it had a selective but not peculiar effect upon the renal cortex.

Mr. A. CROOK (in reply) said that he quite agreed that it was the "odd unusual" case that often threw the most light on the subject. With regard to the remark that the most recent work on the pituitary functions differed from his statements, the paper he had quoted (Sir Edward Sharpey-Schafer) was published in August, 1925.

As to the question of intravenous citrate being given; in his case it was intravenous glucose normal saline that was administered; this had not the defect of increasing the thrombotic tendency in the blood.

He thought that cortical necrosis was a distinct entity, and that the changes in the cortex were not the same as in toxic nephritis of pregnancy.

Section of Pathology.

President—Dr. JAMES MCINTOSH.

Observations on a Little-known Group of Anaerogenic Intestinal Bacteria.

By ALDO CASTELLANI, C.M.G., M.D., F.R.C.P.

I PROPOSE in this paper to discuss a group of intestinal bacilli which, although discovered years ago, have not yet attracted much attention. These bacteria are characterized by the following features :—

(1) They do not produce gas in any sugar.
(2) They clot milk and produce acidity in lactose, or clot milk without producing acidity in lactose, or produce acidity in lactose without clotting milk.

There are several species of this group of bacteria. I may mention *Bacillus ceylonensis* B and *Bacillus ceylonensis* A, which I found in 1905, their description being published in 1907 and 1908 ; as a matter of fact one strain still in my possession was isolated in 1901, but was not classified at that time and was considered to be an atypical dysentery bacillus; *Bacillus gintottensis* which I described in 1910; *Bacillus madampensis* which I isolated in 1910, and described in 1911 ; *Bacillus metadysentericus*, the first strain of which I isolated in 1904, but which was not named for some years. Chalmers and I created for these organisms two genera—*Lankoides* and *Dysenteroides*.

Nabarro has paid much attention to this group of organisms ; he is inclined to identify them with *Bacillus coli anaerogenes*, and in a very interesting publication (*Journal of Pathology and Bacteriology*, xxvi, 1923, p. 429) states the following :—

"Lembke, in 1896, isolated from the excreta of dogs a coliform bacillus producing acid but not gas in glucose and lactose media, to which he gave the name *B. coli anaerogenes*. Between 1905 and 1912 Castellani isolated several varieties in Ceylon which he has named *B. ceylonensis*, *B. madampensis*, and *B. bentotensis*. These organisms all agree in the property of fermenting sugars, etc., with the formation of acid alone ; the difference between them being of a minor nature."

Nabarro further states that he first isolated *Bacillus coli anaerogenes* in 1912 from a case of dysentery at the Wakefield Asylum. In 1921, during an investigation upon summer diarrhœa and other diarrhœal conditions in children, he isolated thirty strains of *Bacillus coli anaerogenes* from twenty-five patients out of 107 investigated.

There is much to be said in favour of Nabarro's theory that the *anaerogenes* bacilli isolated by me, those later isolated by himself, Sonne and others, are identical with *Bacillus coli anaerogenes* of Lembke. As, however, I have been unable to procure Lembke's original *coli anaerogenes* which he isolated from a dog, and as I have always found, since 1907, some serological differences between the principal organisms of the group, I will follow partially the classification of these organisms introduced by Chalmers and myself.

CLASSIFICATION.

As already stated, Chalmers and I grouped these bacilli into two genera : *Lankoides* and *Dysenteroides*. To further understand the classification of this group of bacteria it will be perhaps of advantage to say a few words on the bacterial tribe

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to which they belong, viz., the tribe *Eberthex* Castellani and Chalmers. The tribe *Eberthex* was defined by Chalmers and myself:—

"Bacillaceæ growing well on agar and other ordinary media; not forming endospores, aerobes and often facultative anaerobes: without fluorescence, pigment formation of gelatine liquefaction; without polar-staining; Gram-negative, without a capsule."

This tribe contains the organisms which are usually designated as the typhoid-dysentery, alkaligenes, paratyphoid-Gärtner, coli groups.

The tribe *Eberthex* may be divided into two subtribes:—

(*a*) The organisms do not produce gas in glucose or any other sugar—subtribe *Eberthoanaerogeneæ*.

(*b*) The organisms produce gas in glucose and usually in other sugars—*Eberthoaerogeneæ*.

The first subtribe contains six genera:—

(1) *Alkaligenes*, Castellani and Chalmers.
(2) *Vibriothrix*, Castellani.
(3) *Eberthus*, Castellani and Chalmers.
(4) *Shigella*, Castellani and Chalmers.
(5) *Lankoides*, Castellani and Chalmers.
(6) *Dysenteroides*, Castellani and Chalmers.

The second subtribe contains five genera:—

(1) *Salmonella*, Lignièrs.
(2) *Wesenbergus*, Castellani and Chalmers.
(3) *Enteroides*, Castellani and Chalmers.
(4) *Balkanella*, Castellani and Chalmers.
(5) *Escherichia*, Castellani and Chalmers.

These eleven genera can be easily differentiated by the use of three media: milk, lactose and glucose.

(1) Genus *Alkaligenes*.—Milk not clotted (no change in the reaction of the medium or alkaline); lactose, no gas (no change in the reaction of the medium or alkaline); glucose, no gas (no change in the reaction of the medium or alkaline).

(2) Genus *Vibriothrix*.—Same reactions as *Alkaligenes*, but the organisms of this genus are very polymorphic, vibrio-like, spirillum-like, bacillus-like; all the different forms may be found in the same preparation; they probably belong to the higher fungi.

(3) Genus *Eberthus*.—Milk, not clotted; lactose, no change; glucose, acid; motility +.

(4) Genus *Shigella*.—Same characters as *Eberthus* but motility O.

(5) Genus *Dysenteroides*.—Milk, not clotted; lactose, acid; glucose, acid.

(6) Genus *Salmonella*.—Milk, not clotted; lactose, no change; glucose, acid and gas.

(7) Genus *Wesenbergus*.—Milk, not clotted; lactose, acid; glucose, acid and gas.

(8) Genus *Enteroides*.—Milk, not clotted; lactose, acid and gas; glucose, acid and gas.

(9) Genus *Lankoides*.—Milk, clotted (very slowly); lactose, no change or slowly acid; glucose, acid.

(10) Genus *Balkanella*.—Milk, clotted; lactose, acid or no change; glucose, acid and gas.

(11) Genus *Escherichia*.—Milk, clotted; lactose, acid and gas; glucose, acid and gas.

Key for the Identification of the Genera of the Tribe Eberthex.

The following key for the generic identification of intestinal organisms of the tribe *Eberthex*—viz., non-capsulated Gram-negative, non-sporogenous bacilli which grow well on agar, are aerobic (facultative anaerobic), do not produce pigment, do not liquefy gelatine or serum—may be found useful.

Key to the Genera of the Tribe Ebertheæ.

(Alkaligenes, Typhoid-dysentery, Paratyphoid, Coli groups of Bacteria.)

- **Ebertheæ** ... *Gas in glucose* [Intestinal, non-capsulated bacilli which are aerobic (facultative anaerobic), grow well on agar, produce no pigment, are non-sporogenous, non-capsulated, Gram-negative, gelatine and serum not liquefied]
  - Gas absent (O) Subtribe Eberthoanaerogeneæ—*Milk*
    - Not clotted, acidity in glucose
      - Absent (O or Alk.)
        - Bacillus, *Alkaligenes*
        - Pleomorphic (bacillus, vibrio, spirillum), *Vibriothrix*
      - Present (A), lactose
        - O, motility
          - +, *Erberthus*
          - O, *Shigella*, mannitol
            - O, subgenus *Shigella*
            - A, subgenus *Flexnerella*
        - A, *Dysenteroides*
    - Clotted, *Lankoides*
  - Gas present (+) Subtribe Eberthoaerogeneæ—*Milk*
    - Not clotted, lactose
      - O, *Salmonella*, Maltose
        - O, Morgan group
        - +, Saccharose
          - O, Paratyphosus Group, *sensu lato*
          - +, Asiaticus Group
      - A, *Wesenbergus*
      - AG, *Enteroides*
    - Clotted, lactose
      - A or O, *Balkanella*
      - AG, *Escherichia*, saccharose
        - +, Section communior
        - O, Section communis

O = no change, viz., absence of clotting in milk, absence of acidity and gas in sugar media.
+ = positive, viz., presence of clotting in milk, presence of acid and gas in sugar media, etc.
A = acid. AG = acid and gas. Alk. = alkaline.

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Genus Lankoides, Castellani and Chalmers, 1918.

Definition.—The definition of this genus as given by Chalmers and myself ("Manual of Tropical Medicine," 3rd edit., p. 938) is as follows:—

"Ebertheæ partially fermenting glucose with the production of acid but no gas, lactose fermented only partially, without gas production or not fermented. Milk clotted, usually slowly."

It is important to note that the fermentation of lactose and the clotting of milk are often very slow.

Type Species.—Lankoides pyogenes (Passet, 1902).

Classification.—The principal species recognized as valid by Chalmers and myself are the following:—

Lankoides pyogenes (Passet, 1902).
Lankoides ceylonensis A (Castellani, 1907).
Lankoides ceylonensis B (Castellani, 1907).
Lankoides gintottensis (Castellani, 1910).
Lankoides madampensis (Castellani, 1911).

In our "Manual of Tropical Medicine" Chalmers and I gave a key and a table for the recognition of these germs, based on certain biochemical reactions. This key and table, however, were based on the fermentation reactions shown by these germs after only a few days' incubation (three to six days). I have found that if the organisms are incubated for a longer period, acidity appears in various sugars which at first are not touched; also certain strains which, when recently isolated apparently only ferment a very few sugars, later on, after being subcultured several times are capable of fermenting many more sugars. For instance, most strains of *Bacillus ceylonensis* A and *Bacillus gintottensis* will give acidity in very many more sugars than those mentioned in our key and table, if incubated for over a week; moreover some strains serologically true may produce acidity in numerous carbohydrates even after a short incubation. The best way of differentiating the various species is therefore by serological methods. The study of their fermentative reactions (both simple and by using symbiotic fermentative reactions) may, however, be helpful in some cases.

From a practical point of view the organisms of the *Lankoides* group may be separated into two principal types:—

Lankoides ceylonensis B type—indol positive, production of acidity in lactose usually fairly rapid.

Lankoides ceylonensis A type—indol negative, production of acidity in lactose very slow or absent.

Of each type there are several subtypes or varieties which are best differentiated serologically.

The clotting of milk, especially with certain strains of *Lankoides ceylonensis* A, may be extremely slow, taking three or four weeks.

Inoculation in the Lower Animals.—Serological reactions: Peptone water and broth cultures of *Lankoides ceylonensis* B, strain RR, *Lankoides ceylonensis* B, strain RW, *Lankoides ceylonensis* B, strain LV, *Lankoides ceylonensis* B, strain O, inoculated subcutaneously (1 c.c. to 2 c.c.) in rabbits, do not, as a rule, produce severe symptoms, although there are exceptions. Agglutinins are produced in a fair amount. The rabbits inoculated with any of the four strains of *Lankoides ceylonensis* B will produce agglutinins for the homologous strain, and for the other three strains of *Lankoides ceylonensis* B, in practically the same amount; as a rule there is no agglutination for any strain of *Lankoides ceylonensis* A, or only slight agglutination; *Lankoides ceylonensis* A serum does not agglutinate, or only slightly,

TABLE I.—PRINCIPAL SPECIES OF GENUS *Lankoides*.

[Readings taken after three weeks' incubation at 37° C.]

	Motility	Gram	Gelatine	Serum	Litmus milk	Lactose	Glucose	Lævulose	Maltose	Galactose	Mannitol	Dulcitol	Saccharose	Inulin	Isodulcitol	Inositol	Adonitol	Arabinose	Amygdalin	Salicin	Sorbitol	Raffinose	Dextrin	Erythrite	Glycerine	Potato starch	Indol	Lead agar	Remarks
Lankoides ceylonensis B Castellani 1907 (Strain RR)	O	O	O	O	AC	A	A	A	A	A	A	A	O or A	O	A	O	O	A	O	O	A	A	A	O	A	O or A	+	O	The four strains of *Bacillus ceylonensis* B are serologically identical; strains RR and O produce acidity in lactose rapidly; strain RW very slowly.
Lankoides ceylonensis B Castellani 1907 (Strain RW)	O	O	O	O	AC	As	A	A	A	A	A	A	O or A	O	A	O	O	A	O	O	A	A	O	O	A	O or A	+	O	
Lankoides ceylonensis B Castellani 1907 (Strain LV)	O	O	O	O	AC	A	A	A	A	A	A	A	A	O	A	O	O	A	O	O	A	A	A	O	A	A	+	O	
Lankoides ceylonensis B Castellani 1907 (Strain O)	O	O	O	O	AC	A	A	A	A	A	A	A	O or A	O	A	O	O	A	O	O	A	A	A	O	A	A	+	O	
Lankoides ceylonensis A Castellani 1907 (Strain PD)	O	O	O	O	AC	O or Avs	A	A	A	A	O or As	O	A	O	A	O	O	A	O	O	O	A	As	O	A	O	O	O	Some strains of *Bacillus ceylonensis* A at first produce acid in glucose only; lactose is not fermented or only very slowly; milk is clotted very slowly.
Lankoides ceylonensis A Castellani 1907 (Strain OOO)	O	O	O	O	AC	O	A	A	A	A	O or A	O	O or A	O	O or A	O	O	A	O	O	O	A	Avs	O	O or A	O	O	–	
Lankoides ceylonensis A Castellani 1907 (Strain Z)	O	O	O	O	AC	A	A	A	A	A	A	O	A	O	A	O	O	A	O	O	O	A	O	O	A	O	O	O	
Lankoides gintottensis Castellani 1910	O	O	O	O	DAC	O	A	Avs	O	Á	O	O	O	O	O	O	O	A	O	O	O	O or A	O	O	O or A	—	O	–	
Lankoides madampensis Castellani 1911 (Strain H)	O	O	O	O	AC	A	A	A	A	A	A	O	As	O	A	O	O	A	O	O	Avs	A	A	O	A	O	+	O	
Lankoides pyogenes fœtidus Passet 1902	+	O	O	O	AC	A	A	A	A	A	A	A	A	—	—	—	—	A	—	—	—	A	A	—	—	—	+	–	

O = no change, viz., absence of clotting of milk, absence of acidity and gas in sugar media (the medium may become slightly alkaline).
+ = positive, viz., presence of clotting in milk, presence of acid and gas in sugar media, etc.
A = acid. AC = acid and clot. As = acid slight. Avs = acid very slight – = reaction unknown. D = decolorized.
DAC = decolorized at first, then acid and clot.

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strains of *Lankoides ceylonensis* B; *Lankoides ceylonensis* B serum and *Lankoides ceylonensis* A serum do not agglutinate *Lankoides madampensis* or *Lankoides gintottensis*.

Genus Dysenteroides, Castellani and Chalmers, 1918.

Definition.—Ebertheæ, partially fermenting lactose and glucose with the production of acid, but no gas; milk not clotted.

Type Species.—Dysenteroides metadysentericus (Castellani, 1907). The first strain of this organism was isolated in 1904, but was not named for some years.

Remarks.—This genus contains several organisms which Chalmers and I differentiated at first by means of their sugar reactions into four varieties:—

Bacillus metadysentericus A.
Bacillus metadysentericus B.
Bacillus metadysentericus C.
Bacillus metadysentericus D.

These four varieties are non-motile, but the genus contains one motile species, *Bacillus bentotensis*.

The four varieties of *Bacillus metadysentericus* are better separated by serological methods, as the sugar reactions have a marked tendency to vary. It must also be noted that a number of strains which at first appear as belonging to this genus, belong, in reality, to the genus *Lankoides*; these strains if kept in the incubator at 37° C. for less than two weeks will not clot milk, but if they are kept under observation for more than two weeks their reactions are those of the genus *Lankoides*, milk becoming clotted during the third or fourth week.

Animal Experiments: Toxic Action on Rabbits.—When broth or peptone water cultures are injected in ordinary doses (½ to 1 c.c.) most strains are not toxic. Olivi, with a strain of *Bacillus metadysentericus*, induced the death of a rabbit five days after a single injection of a 3 c.c. dose, while rabbits inoculated with 2 or 1 c.c. did not die. In the rabbits that died inflammatory lesions similar to those found in rabbits inoculated with Shiga-Kruse were shown post-mortem.

Remarks on the Bacilli of the genus Lankoides and of the genus Dysenteroides (Metadysentery bacilli).—In practice it is useful to combine the two genera *Lankoides* and *Dysenteroides* into one group: the *Lankoides-Dysenteroides* group, or *Dysenteroides sensu lato*, because certain organisms which at first present the characters of the genus *Dysenteroides* may, after a prolonged incubation, show the characters of the genus *Lankoides*, viz., will clot milk. The term "metadysentery bacilli," which I introduced some years ago, might perhaps be generally adopted to designate bacteria belonging to either genus.

Clinical Syndromes associated with the Presence of Organisms of the Lankoides-Dysenteroides group.—These organisms have been isolated from clinically typical cases of dysentery; also from a number of cases of obscure chronic colitis with no dysenteric symptoms; and also from certain cases in which fever was a prominent symptom—so prominent as to suggest the possibility of paratyphoid. The blood of the patients in whom *Bacillus ceylonensis* A, *Bacillus ceylonensis* B, and *Bacillus metadysentericus* A, B, C, D, were isolated from the stool contained—in the subacute and chronic cases—a large amount of specific agglutinins for the homologous organisms; in patients, for example, from whose stools *Bacillus ceylonensis* A was isolated it was found that the blood contained agglutinins for *Bacillus ceylonensis* A (strain isolated from the patient and laboratory strains) but not for *Bacillus ceylonensis* B in appreciable amount.

	Motility	Gram	Gelatine	Serum	Litmus milk	Lactose	Glucose	Lævulose	Maltose	Galactose	Mannitol	Dulcitol	Saccharose	Inulin	Isodulcitol	Inositol	Adonitol	Arabinose	Amygdalin	Salicin	Sorbitol	Raffinose	Dextrin	Erythrite	Glycerine	Potato starch	Indol	Lead agar
Dysenteroides metadysentericus Castellani var. A	O	O	O	O	A	A	A	A	A	As	A	O or As	A	O	—	—	—	—	—	—	—	—	—	—	-	—	+ O	—
Dysenteroides metadysentericus Castellani var. A (Strain Z)	O	O	O	O	A	A	A	A	A	A	O or A	O	A	O	A	O	O	A	O	O	O	A	O	O	O	O	+ O	—
Dysenteroides metadysentericus Castellani var. B (Strain L)	O	O	O	O	A	A	A	A	A	A	O or As	O or As	O or As	O	O or A	O	O	A	O	O	A	A	A	O	A	—	+	—
Dysenteroides metadysentericus Castellani var. C	O	O	O	O	A Alk D	As	A	A	As	A	O or Avs	O or Avs	O or Avs	—	—	—	—	—	—	—	—	—	—	—	—	—	O	—
Dysenteroides metadysentericus Castellani var. D	O	O	O	O	Alk	As	A	A	A	A	A	A	A	—	—	—	—	—	—	—	—	—	—	—	—	—	+	—
Dysenteroides bentotensis Castellani	+	O	O	O	A or Alk	A	A	A	A	A	O	O or As	A	O	O	A	O	O	O	O or As	O	O or As	O	O	A	—	+	—

O = negative, viz., absence of clotting in milk, absence of acidity and gas in sugar media (the medium may become alkaline).

+ = positive, viz., presence of clotting in milk, presence of acid and gas in sugar media, etc.

A = acid. AC = acid and clot. As = acid slight. Avs = acid very slight. Alk = alkaline. – = reaction unknown.

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CONCLUSIONS.

(1) The group of intestinal bacilli I have discussed in this paper, viz., the *Lankoides-dysenteroides* group or "metadysentery bacilli," are similar to the dysentery bacilli *sensu stricto* (genus *Shigella*) in that they do not produce gas in any sugar. But they differ from them, however, in the following points: (1) They either produce acidity in lactose and clot milk, or (2) produce acidity in lactose without clotting milk, or (3) they clot milk without producing distinct acidity in lactose. Some of these bacilli have been known for years; *Bacillus ceylonensis* A and B were discovered by me in 1904 and 1905, their full description being published in 1907. I isolated a strain as long ago as 1901, although it was not classified at the time, being considered a non-typical dysentery bacillus—it is still in my collection. I described *Bacillus gintottensis* in 1910; I isolated *Bacillus madampensis* in 1910 and described it in 1911; the first strain of *Bacillus metadysentericus* was isolated in 1904, but was not named for some years. Chalmers and I created two genera for these organisms, *Lankoides* and *Dysenteroides*, but in practice it is an advantage to combine the two genera into one (*Dysenteroides sensu lato*). Some species, as for example, *Bacillus ceylonensis* B, *Bacillus ceylonensis* A and *Bacillus metadysentericus* are pathogenic.

Certain authorities believe that the bacilli of the *Lankoides-Dysenteroides* group, or metadysenteric bacilli, may be identified with *Bacillus coli anaerogenes*, a bacillus which Lembke isolated from the stools of dogs in 1896. Nabarro, who has carried out a very important investigation on the subject, is inclined to favour the opinion that the organisms isolated by me and later on by himself, Sonne and others are in fact identical with that bacillus. I am inclined not to agree with this opinion, as since 1905 I have found constant differences between the principal species of the group, especially with regard to the indol production and serological reactions.

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Further Observations on the "Symbiotic Fermentation Phenomenon," and on its use in the Differentiation of Certain Micro-organisms and in the Identification of Certain Carbon Compounds.

By ALDO CASTELLANI, C.M.G., M.D., F.R.C.P.

THE so-called "symbiotic fermentation phenomenon" described by me may be defined as follows:—"Two micro-organisms neither of which alone produces fermentation with gas in certain carbohydrates, may do so when living in symbiosis or when artificially mixed." I noted this phenomenon in 1904 and 1905, when I first became interested in the composition of baker's yeast; I observed that ordinary

baker's yeast in Ceylon and England consisted, as a rule, of two or more organisms (saccharomyces and bacilli) living in symbiosis, and that baker's yeast *in toto* gas-fermented a larger number of sugars than any of the isolated organisms. In recent years I have used pathogenic germs. The phenomenon takes place only with the use of certain organisms.

Examples: (1) *Bacillus typhosus* alone does not produce gas in maltose (acidity only); *Bacillus morgani* alone does not produce gas in that sugar (neither acidity nor gas). The mixture *Bacillus typhosus* + *Bacillus morgani* will produce gas (fig. 1).

(2) *Staphylococcus aureus* (Ross Institute strain) alone does not produce gas in maltose (acidity only); *Bacillus morgani* alone does not produce gas (neither acidity nor gas); the mixture *Staphylococcus aureus* + *Bacillus morgani* will produce gas.

Technique to put in Evidence the Symbiotic Fermentation Phenomenon.—The phenomenon may be put in evidence when both liquid media and solid media are used.

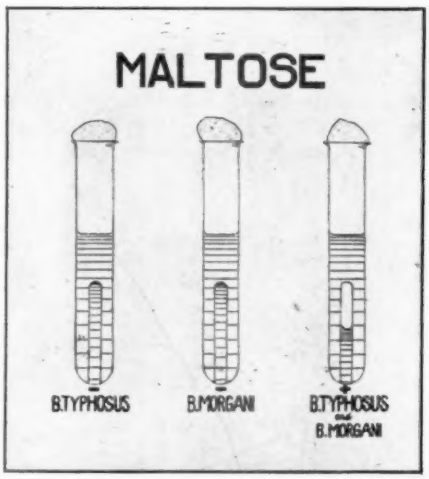

FIG. 1.—Action on maltose of *Bacillus typhosus* alone; *Bacillus morgani* alone, and *Bacillus typhosus* + *morgani*. *Bacillus typhosus* alone, no gas; *Bacillus morgani* alone, no gas; *Bacillus morgani* + *Bacillus typhosus*, gas present.

Liquid Media.—The phenomenon is easily put in evidence by the use of test tubes containing a Durham's fermentation tube, or saccharometers may be used. It is essential that the liquid media employed (maltose, mannitol, etc.) should be made under the use of sugar-free peptone water, not broth which usually contains a small amount of glucose.

Solid Media.—The phenomenon is very evident when solid media are used. The solid sugar media (maltose-agar, mannitol-agar, etc.), are prepared in the usual way but in the preparation of the agar sugar-free peptone water must be used, not broth.

When the phenomenon is positive a large number of gas bubbles will be present.

Explanation of the Symbiotic Fermentation Phenomenon.—According to Harden (1901) and Penfold (1911) and the very recent work of Schütze and Harde, the

phenomenon is due to one of the organisms causing formation of substances which are gas-fermented by the other. In the case of *Bacillus typhosus* + *Bacillus morgani* producing gas in maltose, this is apparently due to the formation of formic acid from maltose by *Bacillus typhosus*; formic acid is gas fermented by *Bacillus morgani*.

USE OF THE SYMBIOTIC FERMENTATION PHENOMENON IN THE DIFFERENTIATION OF CERTAIN MICRO-ORGANISMS.

I have found the symbiotic fermentation phenomenon useful in the differentiation of certain micro-organisms; for instance, organisms of the dysentery group (fig. 2).

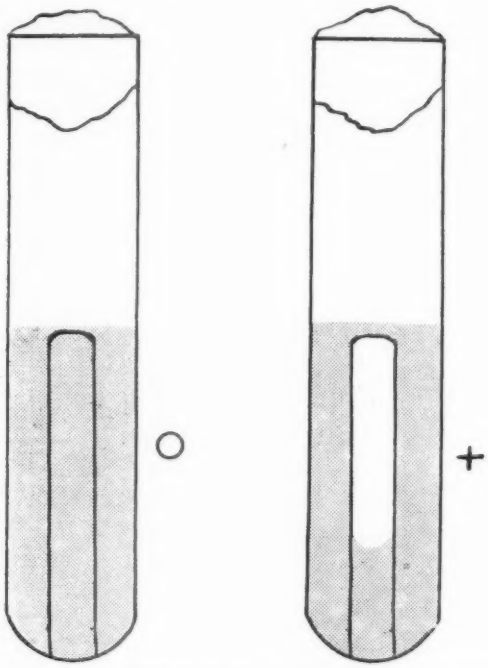

FIG. 2.—Differentiation by means of the symbiotic fermentation phenomenon between *Bacillus dysenteriæ* Shiga, and *Bacillus dysenteriæ* Flexner.

The two principal types of dysentery organisms, Shiga and Flexner *sensu lato*, may be differentiated by using their symbiotic fermentation with *Bacillus morgani*. Shiga + Morgan will not produce gas in mannitol; Flexner + Morgan will produce gas. It may be said, generally, that the results of the symbiotic fermentation largely correspond to the results obtainable with simple acid fermentation, viz., there will be gas in those carbohydrates in which the organism to be identified will produce—alone—simple acidity; the presence of gas, however, is much more striking

than simple acid fermentation; it may, moreover, in certain cases become rapidly evident, while the simple production of acid may be very slow. For instance, there has been some difference of opinion on the point as to whether *Bacillus dysenteriæ* Shiga-Kruse produces acidity in maltose. In old text-books on bacteriology the organism is described as producing slight acidity in maltose, in most of the modern books it is described as not producing acidity. The symbiosis Shiga + Morgan produces gas in maltose and this is in favour of Shiga producing a certain amount, however small, of acidity in that sugar.

Differentiation of Bacillus dysenteriæ Shiga-Kruse, *Bacillus dysenteriæ* Flexner, *Bacillus dysenteriæ* Y (Hiss-Russell), *by means of Symbiotic Fermentation in Mannitol and Maltose.*—The symbiosis Shiga + Morgan produces gas in maltose, not in mannitol; the symbiosis Flexner + Morgan produces gas in maltose and mannitol; the symbiosis Y + Morgan produces gas in mannitol, not in maltose.

The Symbiotic Fermentation Phenomenon in the Identification of Certain Carbon Compounds.

The experiments on this subject will be given *in extenso* in another paper. It is sufficient to say here that the phenomenon is useful in the identification and differentiation of certain carbon compounds. For instance, a Fehling-reducing substance which is gas-fermented by *Bacillus typhosus* + *Bacillus morgani* and not by *Bacillus kandiensis* + *Bacillus morgani* is probably maltose. The explanation is as follows:—The symbiosis *Bacillus typhosus* + *Bacillus morgani* and the symbiosis *Bacillus kandiensis* + *Bacillus morgani* produce gas in the same Fehling-reducing sugars except maltose, in which *Bacillus typhosus* + *Bacillus morgani* produces gas and *Bacillus kandiensis* + *Bacillus morgani* does not. If a Fehling-reducing sugar, therefore, is gas-fermented by *Bacillus typhosus* + *Bacillus morgani* and not by *Bacillus kandiensis* + *Bacillus morgani* the inference is that it is maltose. For the identification of maltose and other carbon compounds, however, the mycological method I devised in Ceylon and later worked out in England with Dr. F. E. Taylor, is much simpler. All the details of the method will be found described in the *Journal of the American Medical Association*, February 20, 1926.

Résumé and Conclusions.

Some years ago I noted that the usual baker's yeast as obtainable in Ceylon and England is not a pure culture of yeast but is generally composed of two or more species of *Saccharomyces* and one or two or more species of bacteria living in close association or symbiosis. I made the observation that the whole yeast, as a rule, gas-fermented more carbohydrates than any of the isolated germs did, either saccharomyces or bacteria. In recent years I have carried out similar experiments, using mostly pathogenic bacteria. What I have called the "Symbiotic Fermentation Phenomenon" may be defined as follows:—"Two organisms neither of which alone produces gas fermentation in certain carbohydrates may do so when mixed together." The phenomenon takes place under the use of certain organisms, one of which apparently must be capable of producing acidity, never gas, in certain carbohydrates.

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The symbiotic fermentation phenomenon may be used in the classification of certain bacteria, and also for the identification of certain carbon compounds.

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Section of Surgery.

SUB-SECTION OF PROCTOLOGY.

President—Mr. J. P. Lockhart-Mummery, F.R.C.S.

Normal Variability of the Action of Pituitrin on the Contractile Power of the Cæcum and Colon.

By E. Ulysses Williams, O.B.E., L.R.C.P.Lond., M.R.C.S.Eng.

In this communication are described the results of an investigation which was undertaken to decide the value of X-ray examination in cases of atonic cæcum.

At one of the meetings of this Sub-Section some time ago, the statement was made that the atonic cæcum could be differentiated from the normal cæcum by the observation of its behaviour after a barium meal and the injection of pituitrin. It was said that the normal cæcum showed marked movements in a few minutes after the subcutaneous injection of 1 c.c. of pituitrin, and that on the other hand the atonic cæcum was unaffected.

Before accepting this statement completely we thought it would be wise, in view of the well-known variability of the intestinal tract in reacting to various stimuli, to observe the effect of pituitrin on the normal cæcum. Fifty-three medical students formed the subjects of the experiment.

Method of Examination.—All the subjects were young and presumably healthy women between the ages of 19 and 26. They were not picked in any way, in fact they were examined as they presented themselves month by month on the X-ray post. The X-ray examination was made twenty hours after the ingestion of the barium meal; during the interval they lived their normal life and took their usual meals. All cases were examined between 9.45 and 10 a.m., i.e., after breakfast. The cæcum and colon were first examined on the screen, and a skiagram taken. One cubic centimetre of physiologically standardized solution of pituitrin was then given by hypodermic injection into the arm, and the cæcum observed two, four and six minutes afterwards in order to see whether any movement was taking place. Finally, twenty minutes after the injection had been made, another skiagram was taken.

The following were the results: Of the forty-nine subjects injected only eight showed any recognizable movement of the cæcum after two minutes.

In the remaining cases the cæcum was unaffected. It appears, therefore, that as so many normal cæcums remain unaffected by the drug, the method is of practically no value in the diagnosis of the atonic cæcum.

[Slides were then shown illustrating the points referred to in the paper.]

92 Norbury—Morgan: *Fistulæ-in-ano*

The Value of Lipiodol in Determining the Extent of Fistulæ-in-ano.

By Lionel E. C. Norbury, F.R.C.S., and C. N. Morgan, F.R.C.S.

This is a preliminary communication; investigations are being undertaken with a view to a more definite orientation of fistulous tracks in relation to the various anatomical planes in the perineum and pelvic regions. Stereoscopic X-rays and the exact localization of the position of the external sphincter are of great importance, and work is proceeding along these lines. We hope to have the opportunity of recording our results in the near future.

Methods of Diagnosis of Fistulæ-in-Ano.

(1) *Digital and Instrumental.*—Pain produced and inaccuracy as to the extent of the lesion are noteworthy. Even at operation, when the tracks are being followed up, it is quite easy to overlook certain branches. (One of the slides to be shown indicates this point.)

If such tracks can be demonstrated before operation by means of lipiodol the advantages are obvious and multiplicity of operations may be avoided.

(2) *Injection of Lipiodol.*—(1) *Method employed*: A glass syringe of 10 c.c. capacity fitted with a screw plunger is used. A cannula is inserted at the external opening of the fistula and gently pushed along the track as far as possible without pain being produced. A bougie is placed in the rectum, the base of which is at the level of the anal orifice. An X-ray photograph is taken before the injection to denote any extraneous shadows, e.g., fæces and gas in the bowel. Lipiodol is then injected slowly, a careful watch being kept for any slight return of the solution alongside the cannula. As soon as oil returns the injection is stopped and a small pledget of cotton-wool is used to block the external opening of the fistula, the cannula being left *in situ*. Any lipiodol on the skin is removed. An X-ray photograph is then taken with the patient lying prone.

(2) *Advantages of the method.*—The statement that many reputations are lost in the treatment of fistulæ-in-ano is a real one, and any help in the exact localization and extent of fistulous tracks is of value.

As we hope to demonstrate by means of lantern slides, it is possible to determine the extent and ramifications of a fistula, and thus enable one to be more definite as to surgical procedure (namely, number of operations likely to be necessary and duration of treatment), and also to be more accurate as to prognosis in a given case. At the same time it is possible to select cases suitable for radical treatment, and reject those which are eminently unsuitable.

We have also noticed, even in apparently inoperable cases, that lipiodol possesses some degree of curative action.

The following lantern slides were shown to illustrate several points:—

Fig. 1.—This shows a simple track in the ischio-rectal fossa with no communication with the rectum.

FIG. 2.

FIG. 3.

FIG. 2.—This shows a posterior horseshoe fistula. The external openings and lateral tracks are well seen. The common internal opening is especially marked, and the overflow of lipiodol into the rectum is well seen.

FIG. 3.—This was a very long track about 8 in. in length, with an internal opening very high into the rectum. This case was not cured. The track is being ionized, and is slowly closing.

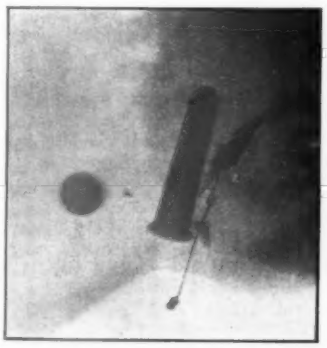

FIG. 4.

FIG. 5.

FIGS. 4 and 5.—These slides illustrate and confirm very clearly the anterior diverticulum of ischio-rectal fossa which is described in books on anatomy. It lies behind the deep layer of the triangular ligament immediately posterior to the symphysis pubis. It is noteworthy that one of these cases (No. 5) was admitted with very few physical signs of perineal inflammation, and the ischio-rectal abscesses, which probably originated in these anterior diverticula, were diagnosed after preliminary exploration with a needle. [1]

[1] "Anteriorly the fossa is partially limited by the reflection of the fascia of Colles round the posterior border of the superficial transverse perineal muscle to join the base of the triangular ligament of the urethra. Above this junction there is a forward prolongation of the fossa, called the *anterior diverticulum*, which extends almost to the symphysis pubis. It lies between the postero-superior layer of the triangular ligament and the inferior surface of the anterior part of the levator ani muscle, and its lateral limits are the prostate and pubo-prostatic ligament internally, and the ischio-pubic ramus externally."—Buchanan's "Anatomy."

94 Maingot: *Gummatous Colitis: Report of a Case*

Mr. ULYSSES WILLIAMS said that he thought the method might be of value in the X-ray treatment of these fistulæ. It was well known that chronic fistulæ were sometimes much benefited by suitable doses of X-rays, and if the sinuses were first injected with some material opaque to the rays, secondary radiations would be set up on the primary ray striking it, and these acting on the walls of the sinus might well prove of more curative value than the primary ray.

Gummatous Colitis: Report of a Case.

By RODNEY MAINGOT, F.R.C.S.

THE term "gummatous colitis" is here used to characterize the chief feature of this case, i.e., the passage, per anum, of large quantities of brown "gummy" material.

It is possible too, that the specimen I have shown may be one of those rare cases of diffuse gummatous (syphilitic) colitis so rarely seen, and so infrequently described in medical literature. Lockhart-Mummery, Golob, and others have wisely pointed out that a localized chronic inflammatory lesion of the colon is not necessarily syphilitic because the patient is syphilitic, or because he has a positive Wassermann reaction.

The supposition that the specimen is a localized syphilitic lesion of the colon is supported by these facts:—

(1) The patient gave a history of syphilis; (2) The Wassermann reaction was strongly positive; (3) The microscopic sections of the affected portion of the gut (although not stained to demonstrate the treponema) showed the typical appearances of a tertiary syphilitic lesion.

The diagnosis of syphilitic colitis would have been undoubted if the treponema had been found to be present in the sections, and it is to be regretted that no search was made for the organism in this case.

History.—I first saw the patient some eighteen months ago. She was a woman aged 46, pale and emaciated.

She complained of abdominal pains, loss of weight, and intractable diarrhœa.

On examination, the abdomen was slightly distended, and a hard, fixed mass could be palpated on the left side on a level with the umbilicus. The liver was not enlarged and there was no ascites. A rectal examination revealed nothing abnormal; and sigmoidoscopy was negative. A barium enema indicated an organic stricture of the descending colon.

She admitted having contracted syphilis at the age of 28; she had had two miscarriages; and the Wassermann reaction was positive + + + +.

A blood-count showed a secondary anæmia with lymphocytosis. In spite of the history of syphilis and the positive Wassermann reaction, I thought I was dealing with a case of removable cancer of the descending colon; and I arranged that the patient should be admitted to hospital with view to operation. After her admission it was observed that she was having from ten to twenty motions a day. Large quantities of foul "gummy" blood-stained material were passed with each evacuation. The diarrhœa could not be controlled by ordinary medical measures, and a short course of anti-syphilitic treatment was not attended with any immediate success.

Operation.—The abdomen was opened through a left paramedian incision; the stricture of the descending colon was localized, mobilized, and delivered through the wound. Resection of the affected portion of the gut was carried out, and axial anastomosis (with cæcostomy) performed.

The patient made a good recovery from the operation; but one month later, on the date of her discharge from hospital, pneumonia developed from which she eventually succumbed.

Pathological Report.

Dr. A. K. Gordon, who kindly cut sections of the tumour and mounted the specimen, reported as follows:—

"The specimen consists of 5½ in. of colon removed by surgical operation and received in 2 per cent. formalin.

Macroscopically.—The whole wall of the gut is greatly and uniformly thickened. On slitting it up the internal surface of the gut is uniformly verrucose, being covered with sessile papules varying in size from 2 to 10 millimetres in diameter. There is no obvious ulceration.

Microscopically.—The mucosa has entirely disappeared and the bowel is infiltrated throughout with cellular exudate of uniform arrangement. The majority of the exudate consists of plasma cells; giant cells are present, but they are scattered and irregular in distribution; and there is no sign of concentric arrangement of lymphocytes or endothelial cells around them. Secondary coccal infection and fibrosis are present. There are no areas of necrosis.

The condition is in my opinion syphilitic and there is no evidence of carcinoma, diverticulitis, tuberculosis, or sarcoma."

Discussion.—Mr. ASLETT BALDWIN: I see no reason why this should not be a case of syphilis in spite of the rarity with which syphilis attacks the large intestine. Some years ago, previously to the use of the Wassermann reaction, I saw a lady who had pain in the anal region, for which a surgeon had removed piles without relief following. He then removed half the coccyx without good result and the rest of it without any amelioration. Afterwards she saw a former President of this Section, who diagnosed carcinoma of the rectum and advised colostomy. The rectum was fixed high up to the sacrum, by a large lump, the centre of which was occupied by a deep, hard ulcer; it certainly felt very like carcinoma. The history made me suspicious of syphilis. Successful results were obtained under a treatment by mercury and iodide of potassium. The patient was under my observation for about ten years.

Dr. E. STOLKIND said that to find spirochætes in the tissue of any syphilitic specimen it was necessary to take it about one to two hours after death, as the spirochætes generally disappeared soon after death.

Volvulus of the Pelvic Colon and Blind Cæcostomy.

By W. B. GABRIEL, M.S.

IT is generally thought that volvulus of the pelvic colon is the one cause of acute obstruction of the large intestine,—obstruction which is not relieved by blind cæcostomy. I think the following recent experience in this connexion should be recorded.

Case.—Mrs. E. M., aged 71, was admitted as an emergency case into the Royal Northern Hospital under my care on August 14, 1926. She gave a history of eight days' complete intestinal obstruction. She was a frail looking woman who had evidently been very stout at one time. Her mental condition was not very clear. On examination her abdomen was seen to be enormously distended and extremely tense. No tumour could be felt, and rectal examination gave no help.

Operation.—Under spinal anæsthesia I made an oblique incision in the right iliac region; on incision of the peritoneum part of the circumference of greatly dilated large bowel presented. I sutured this to the parietal peritoneum leaving an area of bowel about the size of a penny exposed extraperitoneally; into this I stitched a length of drainage tubing. Drainage proved successful, the patient passed pints of fluid fæces, and in two days' time her abdomen had become quite flat.

A week after the first operation I did a mid-line sub-umbilical laparotomy, again under spinal anæsthesia, thinking I should find a carcinoma somewhere in the colon, and was surprised not to find any growth. The pelvic colon was contracted, but its walls were greatly thickened and it had evidently been involved in the recent obstruction: a voluminous loop of the pelvic colon was found passing across to the right iliac fossa where it was adherent at the first operation site. The cæcum was free and normal. In view of her poor general condition I thought it would be unwise to attempt to free the colon from the site

of its adhesion: the wound there was septic, and the bowel closely adherent, as resection of the affected loop would have involved a great risk of the onset of peritonitis. I therefore closed the mid-line incision, and put a few stitches into the bowel so as partially to close the fæcal fistula.

Subsequent Course.—The median incision healed completely. The fæcal fistula continued to discharge, but with rectal wash-outs a certain amount of fæces began to be evacuated per rectum. Her mental condition became worse and she was transferred to an infirmary on September 11. Upon inquiry in November I ascertained that she was alive, but was continuing in a low state, and that the fæcal fistula in the right iliac region had not closed.

Commentary.—A blind drainage operation saved the patient's life in this case of acute intestinal obstruction. The explanation, I think, must be that the primary condition was a volvulus of the pelvic colon which I was fortunate enough to tap at the apex of the loop, which subsequently became untwisted when tension was relieved. The patient was a very poor subject, advanced in years, and in a desperate condition; yet although a fæcal fistula remains there is a reasonable chance of its closing. The result of the case supports the principle and demonstrates once more the life-saving character of the operation of "blind cæcostomy" in late cases of obstruction of the large intestine.

Skin Grafts for Fistulæ.

By W. B. Gabriel, M.S.

My attention was drawn to the possibility of skin-grafting a granulating fistula wound by a case under my care in St. Mark's Hospital. The patient was a woman, aged 33, for whom I laid open a fistula, leaving the customary large wound to granulate. About ten or twelve days later there was evidence of a spontaneous skin graft; a small area of white epithelium appeared in the centre of the granulating surface and spread rapidly. Healing from the margins took place at the usual rate, and she made an extremely rapid and satisfactory recovery. The fistula remains firmly healed.

Since then I have attempted a skin graft in two cases. In the first one I applied some Thiersch grafts and covered them with wet saline gauze, but they failed to take. The second case proved successful and is shown to-night. The patient, a man, aged 24, had a large peri-anal abscess which was laid open on October 30, 1926. It cleaned up very well, and on November 19 I applied four Thiersch grafts to the raw surface, without using a dressing. The grafts were left exposed to the air and were kept moist by dropping saline on to them every few hours. Three of the grafts took well, as shown in the accompanying photographs, obtained

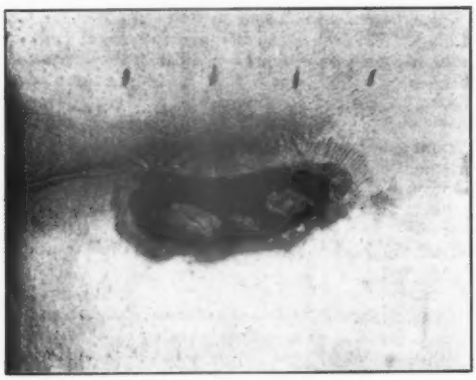

Fig. 1.—Shows Thiersch grafts five days after application. The graft on the inner aspect has not survived. The marks on the skin indicate inches.

five and nineteen days after skin-grafting. The final stage of healing proceeded very rapidly, and the patient was discharged with the wound completely healed on December 11, 1926, twenty-two days after skin-grafting. The wound remains well healed and the scar of the grafted portion is perfectly firm.

Commentary.—In selected cases of fistulæ with flat, granulating surfaces Thiersch grafting appears to be a good method of accelerating healing.

I hope to report further on this matter at a later date.

FIG. 2.—Shows the fistula nineteen days after skin-grafting. Healing at this stage proceeded very quickly and was complete three days later.

Dr. CUTHBERT DUKES, O.B.E., showed specimens of the following conditions :—

(1) Thrombosis and Organization of the Venous Clot in Fibroid Polypi of the Anal Canal.
(2) A Cancer of the Rectum which had undergone Calcification in the Centre.
(3) A Colloid Cancer of the Transverse Colon.
(4) A Fungating Adeno-carcinoma of the Lower End of the Rectum which Presented at the Anal Margin an Appearance Suggestive of an Epithelioma.

Section of Urology.

President—Mr. W. Girling Ball, F.R.C.S.

The Treatment of Malignant Disease of the Urinary Bladder.

By Henry Wade, C.M.G., D.S.O., F.R.C.S.Ed. (Edinburgh.)

In the practice of surgery the risks we run and the operations we practise are based on the knowledge of the ultimate fate of the patient if the disease remains untreated. This is weighed against the immediate danger associated with the operation and the degree of disability which will result as a consequence of the mutilation attendant on the treatment. Judged by such a standard, almost any risk is warranted in dealing with cancer of the urinary bladder.

Wherever malignant disease may be situated, therefore, the ideal form of treatment is to remove it entirely.

Unfortunately, this ideal is seldom obtainable. The environment of the growth may prevent the radical excision we would prefer. More usually this is rendered impossible by the advanced degree of dissemination of the disease which is found to be present. In such cases where complete and radical excision of the primary neoplasm is impossible, in many parts of the body it will be found that the patient's discomfort can be markedly alleviated, the nutrition improved, and life prolonged, by the performance of a palliative operation.

Naturally, when considering what can be done to relieve the distress of the patient's sufferings from irremovable cancer of the bladder, the benefit to be derived from the performance of a suprapubic cystotomy is considered. In my experience, this is useless. Similarly, for reasons I will advance later, little benefit follows bringing both ureters out on the loins, or implanting them into the bowel in such cases.

Unfortunately, in carcinoma of the bladder, as far as I am aware, no palliative operation is possible that will alleviate the inevitable painful and miserable end at which such patients ultimately arrive.

In considering the treatment of malignant disease of the urinary bladder, it must be acknowledged that, although, on the one hand, it provides a class of case which, frequently, eventuates in an end of the utmost human misery, there is one class of case in which the result is extremely satisfactory. I refer to those cases in which there are revealed at the pathological examination of the specimen removed at the operation early signs of malignant disease at the base of what was clinically taken to be an innocent villous papilloma. When first met with we are apt to be unduly alarmed by this report.

A large papilloma of the urinary bladder has been removed by open operation. In doing so, you may have excised no more of the surrounding healthy mucous membrane than was elevated by traction on the pedicle of the growth. The tumour removed you considered clinically innocent. When therefore the report of the pathologist came to hand, you, naturally, anticipated a confirmation of its innocence. To your surprise and alarm, you were informed that, although the main portion of the tumour showed the structure of a very proliferative papilloma, innocent in nature, the pedicle was infiltrated, the tumour showing malignant changes at its base. Such has been my experience on several occasions, and, naturally, these cases have been followed by me most carefully.

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Recurrent papillomata have developed in several of them, but so far none of them has ultimately eventuated in an infiltrating cancer requiring cystectomy.

As an illustration, I would cite the case of a patient, a spinster, aged 64, who originally came under my care on June 6, 1923, suffering from hæmaturia. Cystoscopic examination revealed this to be due to a tumour which had the appearance of a sessile papilloma. At the operation, a large fungating papilloma was revealed, attached to the bladder wall by a stout pedicle. This tumour was removed and there was also excised a smaller growth on the right side. The pathological report was that the large tumour showed the structure of a very proliferative papilloma with the changes at the base that I have mentioned. The smaller tumour was innocent throughout.

Cystoscopic examination five months later showed no signs of recurrence. After this I did not see the patient again for a year, and on examining her then the bladder walls showed a large number of papillomatous tumours, small in size, with a large growth on the roof of the cavity. An endeavour was made to destroy these by fulguration on several occasions, but, ultimately, the patient lost heart, and on our failure to eradicate the disease, open operation was again resorted to, and one large and two small growths were removed. The pathological report on this occasion was similar to that previously given, the bulk of the tumour being innocent in nature, but malignant changes were present at the base. Three months after this operation, early recurrence of the disease was observed at two areas and these were destroyed by fulguration under a general anæsthetic, after which she remained free from disease until a year ago, when recurrence was again noted, and fulguration was again carried out under a general anæsthetic; since that date she has been examined regularly at intervals of six weeks, without showing any signs of return. At the last examination, which was carried out a fortnight ago, the bladder walls appeared perfectly healthy in every respect, and the urinary tract was entirely normal and free from disease.

The interesting point in this type of case is that in the opinion of competent pathologists the sections made from the base of the growth indicated the undoubted presence of malignant disease. At the same time, it must be granted that frequently a very limited local removal will be sufficient to produce a permanent cure, such as was obtained in the case I have cited. Although the end result may be fortunate, the value of the lesson learned is none the less great; it is that a clinical appearance, on cystoscopic examination, of perfect innocence, even combined with the cytological structure of an innocent villous papilloma in a portion removed by the cystoscopic rongeur, may be observed where early cancer of the base of the growth is present. In a patient, therefore, whose age is in the cancer decade, such growths, although apparently innocent, should receive radical treatment. If fulguration be the method adopted, it should be thorough. If the size of the growth raises the question of the advisability of its removal by open cystotomy the decision should be in the affirmative. Repeated fulguration in such cases may eventuate in a disseminating cancer.

As Mr. Jocelyn Swan has pointed out, it is difficult to draw the line between innocency and malignancy in cases of papilloma of the bladder. In his recent Presidential Address,[1] he dealt fully and lucidly with the subject of these epithelial vesical tumours.

The cases to which I desire to refer especially are those that are obviously malignant. They occur in various types. They may be classified as:—

(1) Malignant papilloma.
(2) Papillary carcinoma.
(3) Scirrhous carcinoma.
(4) Squamous carcinoma.
(5) Adeno-carcinoma.

My experience of these cases has been that their clinical recognition is easy. The patients invariably come to you on account of hæmaturia, which is of a rapidly

1 *Proceedings*, 1925-26, xix (Sect. Urol.), 1-9.

increasing frequency and severity, and is associated with increased frequency of micturition, and a characteristic suprapubic discomfort. Cystoscopic examination enables the presence of the disease to be recognized readily. At the same time, I have found it extremely difficult to determine accurately before operation the actual extent of the dissemination of the disease on which to base an exact estimation of the extent of the operative treatment that will be required. I have found that it is only when the bladder is opened that the extent of the infiltration of the wall can be correctly estimated, and this is made out on manual examination. Both you and the patient must therefore be prepared for a number of possible lines of treatment.

The treatment of a primary carcinoma of the urinary bladder will be determined by the situation and the extent of the growth. The most satisfactory cases are those in which the tumour is situated on the summit of the organ; this permits of a partial cystectomy being carried out. A widespread excision can usually be made, at the conclusion of which a cavity may be left which will only contain an ounce or two of fluid. It is satisfactory, however, to note how rapidly a cure takes place in this respect, the normal capacity being restored in a few months.

Before proceeding to treat such cases, it is wise to make sure that the growth observed on the summit of the bladder has not arisen in an organ outside that cavity and invaded it.

I have had two such cases: in one a primary carcinoma of the small intestine was present which had become adherent to the bladder. A bismuth meal examination showed partial obstruction of the small bowel at this level. The other was due to a primary malignant tumour of the ovary. Its presence was suspected owing to the severe bleeding which followed a bimanual examination. The bleeding was much more intense than could be attributed only to the manipulation of the bladder tumour. In both cases, the primary growth, along with the portion of the bladder involved, was successfully excised.

Where partial cystectomy is not sufficient to remove the growth, a hemicystectomy with excision of a portion of one ureter may be performed. The problem in such cases is how to treat the divided ureter. In the majority I have re-implanted it into the bladder.

Recently, I have employed another method successfully in three cases, and I would commend it for your consideration. It has consisted of leaving the severed ureter *in situ*, and closing the bladder, except at its upper part, where it allows exit to a suprapubic bladder drain and at its lower part in the region in which the normal ureteral orifice would have existed. Down to this latter region a rubber dam and gauze tampon are carried laterally to the sutured bladder wall. At the end of the operation, through the closed wound two drains pass, one into the bladder cavity, the other down to the divided ureter and the lower opening in the bladder. In these three cases the patients have all done well. Their convalescence has been interesting. From the first, the greater part of the urine was drawn off by the bladder drain, which was connected with a Bunsen bottle suction apparatus. From the first day, the patients have required frequent dressing owing to the soakage of urine from the tampon. In five days' time, this was withdrawn and the sinus gradually healed, until, ultimately, all the urine came away by the suprapubic wound, which in its turn also closed and natural micturition was re-established.

The object underlying this line of treatment has been to produce a diverticulum of the bladder into which the severed ureter opened. In all of the three cases, this appears to have taken place, and to confirm this point, I re-examined one of the patients ten days ago, that is, one year after the original operation, and observed that this had taken place.

The treatment of carcinoma of the bladder, where neither of these methods is possible, now remains to be considered. In doing so, we presuppose a case in which it has been established that a tumour is present, malignant in nature, invading the bladder wall but still intrinsic to it, and its removal is impossible without sacrificing both ureters, which is frequently the case, without their being actually involved in the disease. The patient's health also has not been so broken down as to contra-

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indicate the performance of a major operation. In such a case, I consider that total cystectomy is indicated. I am aware that certain surgeons, even so great an authority as Hugh Young, state that they have never felt justified in carrying out the operation of total cystectomy. I advocate its employment as I know of no other means of curing the patient, nor of any palliative operation or treatment which will materially relieve the ultimate suffering.

I cannot claim to speak with authority on the value of X-ray or radium therapy in such cases, but my limited experience is in confirmation of most others that they are not curative agents.

I have already mentioned that I know of no palliative operation which will benefit the patient, and I have mentioned that on the line of reasoning applicable elsewhere in the body it might have been assumed that the constantly recurring, painful, spasmodic contractions of the bladder from which the patients suffer might be relieved by a suprapubic cystostomy. Unfortunately, such is not the case, and when this is done no relief from these spasms is obtained, for they are not due to the accumulation of urine in the cavity, but to the invasion of the contractile walls of the bladder by the new growth. Proof of this is forthcoming from the fact that they persist in as severe a degree after both ureters are severed and the bladder permanently emptied of urine.

The performance of the operation of total cystectomy can be criticized on various grounds: the suitability of the case, the danger of the operation, and the ultimate mutilation of the patient, with the distressing discomfort attending this. As regards the suitable case, the decision to perform this operation is a grave one, so much so that up to the present I have not felt warranted in recommending it without having previously determined the state of affairs present by opening the bladder and examining its interior. If this could be dispensed with, the operation would be simplified.

At present, I would only recommend its performance in cases of carcinoma of the type I have mentioned, although, when simplified and improved, I can imagine it being done in the majority of cases of vesical carcinoma.

The probability that the disease has extended beyond the bladder and that even total cystectomy will not remove it entirely has been advanced as a reason against its performance as in such a case the disease will re-manifest itself and still cause the death of the patient.

I have observed this on two occasions; in both it reappeared in the pelvis one and a half years after the original operation of total cystectomy, but even the patients' ultimate end, instead of in my opinion contra-indicating the operation, was an argument in favour of it. A painless swelling, like an encephaloid carcinoma in the female breast, appeared and gradually increased in size. The patient gradually sank and died in peace.

As a palliative gastrectomy is warranted in certain cases of cancer of the stomach, a palliative cystectomy similarly might be warranted from the relief it affords.

The dangers that are attendant on the operation of total cystectomy are not in themselves such as to contra-indicate its performance.

I have carried out the operation on four occasions and in each of the cases the patients recovered from the operation which proved neither difficult of execution nor attended with undue shock. Two of the patients are still alive and the other two lived for nearly a couple of years after the operation.

The last criticism is the mutilation of the patient and the discomfort attendant on it. This raises the unsolved problem of how best to arrange for the deflection of the urine stream after the bladder has been removed. A similar problem arose in the treatment of vesical exstrophy and has been successfully solved.

No one will dispute the fact that if, when a total excision of the urinary bladder is being carried out, arrangements could be made for the successful deviation of the

urinary stream into the large bowel, this arrangement would be the most comfortable for the patient.

In cases of extroversion of the bladder, where it has been done, the patients' lives are soon rendered very comfortable, so much so that many of them can pass an undisturbed night in bed without having to rise to void urine from the rectum. Unfortunately, the patient who is being operated upon for advanced malignant disease of the bladder is not comparable to the one who is being treated for vesical exstrophy. I think it is probable, therefore, that in the majority of cases of total cystectomy arrangements will have to be made to bring the ureters to the skin surface.

In deciding where to transplant the ureters on to the abdominal surface, the position is mainly determined by the site at which the collection of the urine can be most conveniently carried out. Personally, I favour the lateral aspect of the anterior abdominal wall. The operation is easy, speedy and safe, and a fortnight after it has been performed the operation of total cystectomy can be carried out.

The difficulty that is still unsolved is how best to arrange for the collection of the urine as it flows out on the skin surface. Ureteral catheters passed into the renal pelves are tolerated astonishingly well, but even these are insufficient to collect all the urine. After many attempts we have contrived an apparatus that is fairly satisfactory, but even with it the difficulty is to get it to act equally efficiently with the patient in the upright, sitting or recumbent posture.

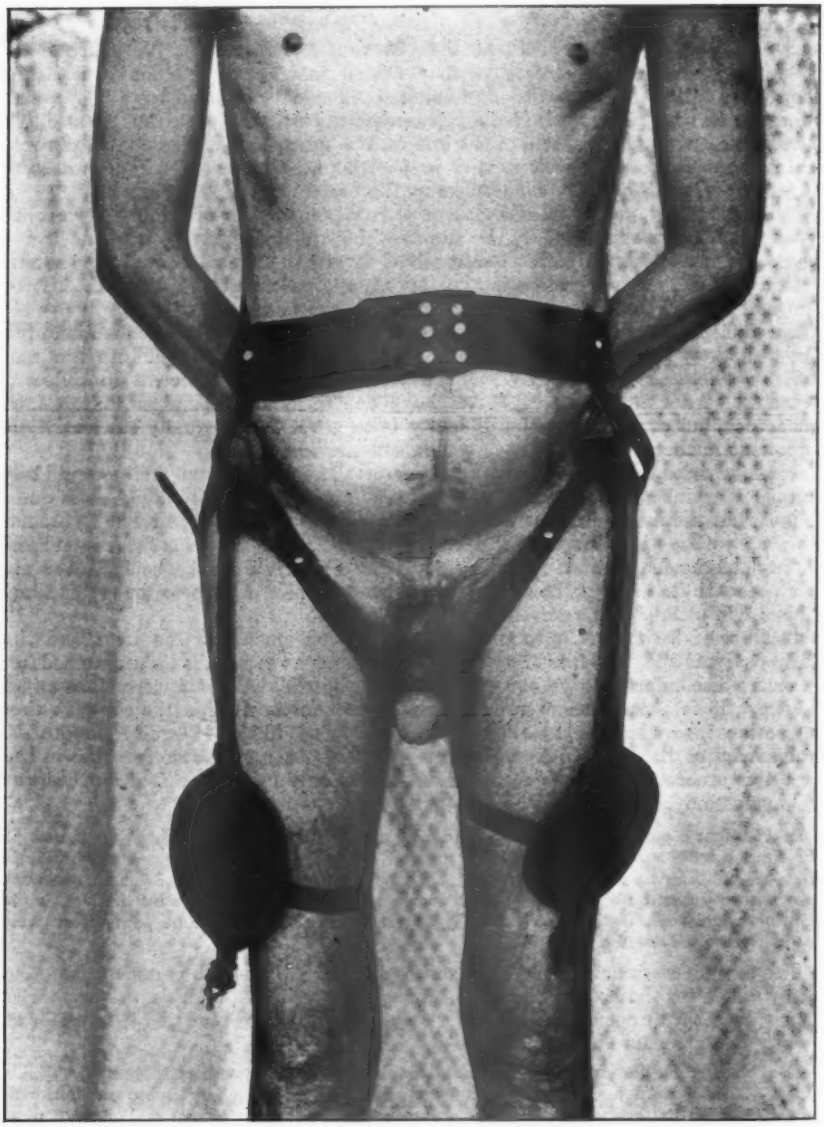
We have tried on four occasions to carry out plastic operations which would leave a nipple of skin at the outlet of the ureter. The difficulty in doing so is due to the fact that the ureter is a contractile tube, and although it will readily remain viable up to the skin surface, we have failed in getting it to persist beyond this, whether surrounded by a skin flap or carried for a short distance beneath the skin with a view to its being mobilized later to form a nipple. I have no doubt this simple problem will ultimately be solved.

In all cases in which I have transplanted the ureters on to the loins and thus totally deviated the stream from the bladder, little or no relief has been obtained from the severe discomfort due to the persistent, spasmodic, painful contractions of the bladder. It is thus demonstrated, as I have previously mentioned, that these contractions are due, not to the presence of urine in the bladder, but to the involvement of its wall with malignant disease. As a palliative measure in such cases this proceeding is therefore valueless, and is only useful as a step antecedent to total cystectomy.

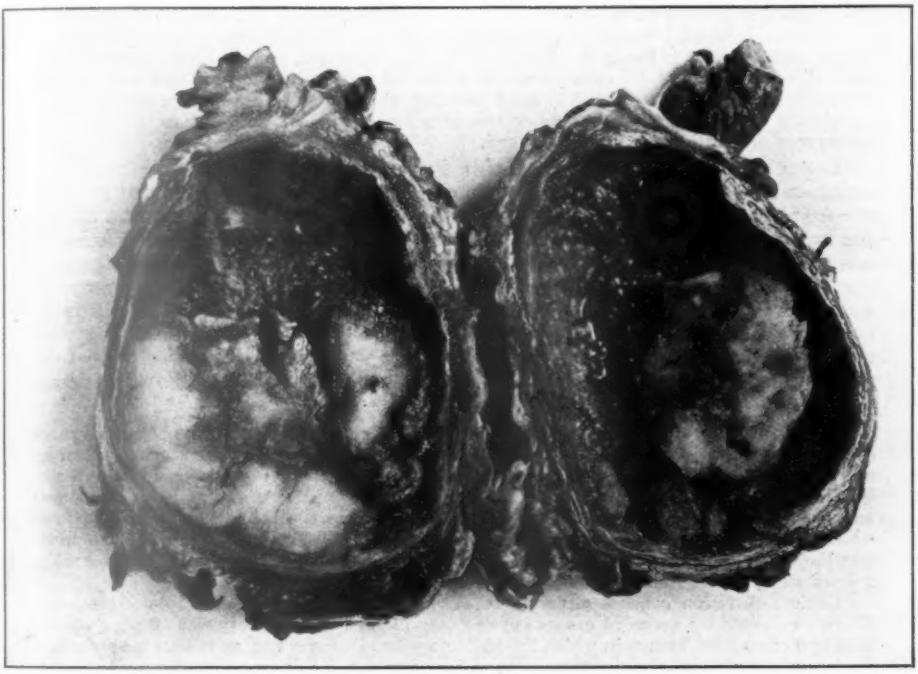
In the four cases in which I have done total cystectomy, all the patients were males. A very similar technique was employed in each. The distended bladder was excised, together with the prostate and seminal vesicles, through a suprapubic incision. The operations were neither difficult nor attended with serious shock, and a noteworthy feature of the patients' convalescence was the relief they obtained from the persistent pains from which they had previously suffered.

The final operation, in which the entire bladder is removed, is undertaken about three weeks after the ureters have been transplanted. If before it is performed, the bladder, which was opened, has closed, the operation will be rendered much safer and easier. The procedure is as follows:—

The bladder is first of all filled to its maximum capacity with 1/1000 nitrate of silver solution. The peritoneal cavity is then opened through a mid-line suprapubic incision, which is carried down to the symphysis pubis, exposing freely the extraperitoneal portion of the anterior surface of the bladder. The healed scar and cicatricial tissue of the previous cystotomy operation are left attached to the anterior surface of the unopened bladder. The peritoneum is then dissected off the summit and posterior aspect of the bladder, the obliterated hypogastric arteries and urachus being divided. The bladder is now further mobilized by blunt dissection, the hand being swept around its lateral and posterior surfaces



Near view showing the rubber cups over the ureteral orifices.



Total cystectomy and prostatectomy for carcinoma of the bladder.

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in order to separate it from the loose areolar tissue to which it is attached, a procedure which is easy if the bladder is firmly distended. When this is being done the superior vesical arteries are isolated, ligatured and divided. The vas deferens on each side is now defined, isolated and divided. The ureters have already been severed close to the bladder at the previous operation. The partially isolated bladder is now pressed firmly backwards and the strong vascular cord, the pubo-prostatic ligament, is defined, clamped with strong curved hæmostatic forceps, and divided. The anterior surface of the prostate is now brought into view and cleared down to the apex of the gland. In a similar manner the lateral and posterior aspects of the prostate are freed. In doing so the seminal vesicles are isolated and carried forwards along with the bladder and prostate to which they are adherent. The prostate is now drawn out of the muscular hammock in which it is slung, this hammock being formed by the levator ani muscles on either side and the recto-urethralis muscle below. The prostatic urethra is finally divided, cauterized and ligatured, and the bladder, prostate and seminal vesicles removed in one piece. The divided pelvic peritoneum is now reunited and the peritoneal cavity closed with a gauze tampon loosely packed into the space from which the bladder was removed. The mid-line wound in the abdominal wall is now sutured with the tampon drain emerging at its lower end.

I would ask the Members of this Section, therefore, to review again the circumstances under which the operation of total cystectomy is warranted in cases of carcinoma of the bladder. If we consider, as we must, that it is possible by this and by no other means to obtain a cure from this terrible disease in certain selected cases, are we justified in withholding the prospect of this from those who elect to take the risk attendant on it? I believe that the operation of total cystectomy for carcinoma of the bladder has a definite place in surgery as a legitimate remedy for a desperate and dread disease. I consider that it is an operation the technique of which is capable of great improvement, and when this has been achieved the patient will be left free from disease in tolerable comfort and capable of a life of moderate activity.

Discussion.—Sir JOHN THOMSON-WALKER.[1]—The non-operative treatment of advanced malignant growths of the bladder by means of the hard X-rays (Erlangen technique) or by radium may be set aside at the present time. In my experience radiation in these cases is followed by a severe reaction which greatly increases the misery of the patient without any prospect of curing the growth. The treatment is therefore confined to operative measures which are either palliative or radical. Exclusion of the bladder by implantation of the ureter into the bowel gives relief from the bladder symptoms and may be considered as an alternative to cystostomy where radical measures are inadvisable.

Radical operation consists either in resection of the bladder wall or in total cystectomy. When I collected the recorded cases of cystectomy in 1909 the mortality was 46 per cent. and only two cases were known in which the patients were alive over two years after the operation. Under such conditions the operation of total cystectomy was a desperate measure and outside the range of practical surgery. Since that time more encouraging statistics have been published, notably those of Federoff, the collection by Schule, and a few in the Mayo Clinic statistics. The time is therefore ripe for the work that Mr. Wade is bringing forward and for a general discussion of the subject. My personal view is that if the operation of total cystectomy can be shown to be a comparatively safe operation, the chief point on which a variation of opinion is likely to arise is the question as to what cases are suitable for the operation. How far will such an operation trench on the cases that at present we consider suitable for partial cystectomy? If the cases are to be confined to those where no partial resection is possible, what advantages are there in regard to comfort and duration of life over palliative operation? This latter question will, I hope, be answered by Mr. Wade to-night.

In regard to the operation of partial cystectomy, at the present time the results have, in my experience, been extremely good. In 1925 I collected my cases up to the end of 1924 for an introductory address at the Meeting of the Association of Surgeons of Great Britain. The following were my results: 126 operations of resection of the bladder for malignant growths with 8 deaths after operation (6·34 per cent.). Among these cases there were 27 in which the ureter had been transplanted to another part of the bladder.

[1] This communication was read, as Sir John Thomson-Walker was unable to attend the meeting.

Of the surviving patients I traced 81, and of these there was recurrence within three years in 22 (27·16 per cent.). There was recurrence three years and more after the operation in 5 (6·17 per cent.) and no recurrence three years and over in 28 (34·56 per cent.). The cases of non-recurrence included freedom for four to five years 3, five to six years 3, six to seven years 4, seven to eight years 5, eight to nine years 1, nine to ten years 2, ten to eleven years 2, eleven to twelve years 1, thirteen to fourteen years 1, and sixteen years 1.

With increasingly early diagnosis due to the education of the general practitioner and of the public, I feel sure that these statistics will be improved upon. There does not seem to me, therefore, any call to supersede the operation of partial cystectomy for malignant growths for that of total cystectomy in cases where, in the opinion of an experienced surgeon, partial cystectomy is possible.

But here I can see a likely divergence of opinion in selecting cases. For the surgeon constantly dealing with bladder operations will be able to include a very much greater proportion of cases of growth in his partial cystectomy list than would the surgeon who only occasionally sees cases. The latter would turn to total cystectomy with its consequent mutilation in many cases where the former would perform partial cystectomy and retain a functional bladder. There are, however, cases in which partial cystectomy can be definitely ruled out on account of the extent of the growth in the bladder or on account of its position. In these cases no question of a better radical operation can arise.

In cases of this nature two serious complications are not infrequently present, namely, infection from previous treatment or operation and renal insufficiency from obstruction of the ureters by pressure of the growth. These complications must tell against the immediate and ultimate results of complete cystectomy.

In 491 cases of bladder growth under my care up to the end of 1924, 118 were unsuitable for a radical operation. In seventy-six the cause of the inoperability was noted as follows:—

Extent alone	52
,, and sepsis	8
,, and position	9
,, and general condition ...	5
General condition	1
Position and age	1
	76

Certainly a large proportion of these cases would have been submitted for total cystectomy had the results of this operation been such as to hold out a reasonable prospect of recovery from the operation, or survival afterwards.

Mr. J. SWIFT JOLY congratulated Mr. Wade on the results he had obtained. He (Mr. Joly) had never performed the operation of total cystectomy, because he found that in every case in which a partial cystectomy was impossible, and in many cases where it was possible, the disease had spread far beyond the confines of the bladder. It was quite common to find extensive carcinomatous deposits in the glands surrounding either the internal or the external iliac vessels. For this reason, he had come to the conclusion that total cystectomy was an operation which had practically no place in bladder surgery. If the growth was still confined to the bladder wall, it could always be removed entirely by an extensive resection; if it had spread into the peri-vesical tissues, no operation would save the patient's life. Mr. Wade had raised the point as to whether it was justifiable to perform a total cystectomy as a palliative operation, solely to relieve the patient of his pain and discomfort. Anyone who had seen patients dying from vesical carcinoma could have no doubt that any operation which would relieve their symptoms was well worth trying. He had found a cystotomy to be useless in these cases, but had observed a considerable amount of relief following a bilateral ureterostomy. If he thought the patient would stand a complete cystectomy, he would perform it in the future, but he thought that comparatively few of these patients would survive the operation.

Mr. KENNETH WALKER expressed agreement with Mr. Wade when he stated that all palliative measures failed in the treatment of malignant diseases of the bladder. How seldom did the establishment of a suprapubic fistula afford any relief to the patient suffering from frequent and painful micturition. Radium was ineffective except perhaps in obtaining a temporary arrest of hæmorrhage, and X-rays were of no account in curative therapy,

although perhaps they might be used as a prophylactive measure after excision. It was true that operation, even although it failed to extirpate the disease, often provided a less distressing future for the doomed patient. However, although this was often the case, it was not always so, and he could remember cases in which the discomforts of the patients had apparently been little reduced by a previous unsuccessful effort to eradicate the disease. In conclusion he would ask Mr. Wade what direction his future efforts would take with regard to the disposal of the ureters. Did he intend to continue transplanting on to the surface and devising more effective mechanical cups, or did he not rather think that better chances of success lay in the direction of an improved method of implantation into the bowel?

Mr. A. CLIFFORD MORSON said that the treatment of malignant disease of the bladder by X-rays and radium had been strangely disappointing in its results. The tumour when exposed to irradiation might shrivel and hæmaturia might cease, only to be followed, at a later date, by a flare up into activity of the reproductive power of the malignant cells, accompanied by severe cystitis. On theoretical grounds, Mr. Henry Wade's advocacy of total cystectomy for cancer had much to commend it, but it was a terribly maiming operation and must be attended with high mortality. The technique of removing the prostate, together with the whole bladder, would appear to increase still further the gravity of this surgical procedure, and was unnecessary so far as lymphatic spread was concerned.

Mr. WADE (in reply) said that the statistics submitted by Sir John Thomson-Walker of cases of partial cystectomy for malignant disease demonstrated the value of this operative procedure, the safety attending it in his hands, and the frequency with which a complete cure could be obtained. The repair of the bladder that took place after these operations was remarkably complete, and, undoubtedly, where this operation was possible, it was infinitely to be preferred to any more radical procedure necessitating the sacrifice of bladder cavity. At the same time, as Sir John had mentioned, there were many cases where partial cystectomy would not be sufficient and only by total cystectomy could the disease be removed.

Mr. Swift Joly had found a considerable amount of relief to follow the performance of a bilateral ureterostomy. This operation, undoubtedly, tended to prolong life, in diminishing the risk of damage to the kidneys from backward pressure. At the same time, it did not relieve the patient of the recurring spasmodic contractions of the bladder, which, as had been already mentioned, were due to the invasion of its walls by malignant disease, and not to the presence of the urine within it.

Mr. Kenneth Walker had asked in what direction future efforts would take with regard to disposal of the ureters. Undoubtedly, when the operative technique had been simplified and the diagnosis of suitable cases made at an early stage before the patient's health was broken down, the ureters would be transplanted into the large bowel before the operation of cystectomy. At present, however, the cases that came to us for the drastic treatment of cystectomy were such as to contra-indicate this ideal procedure, and in these the ureters were transplanted on to the abdominal surface, an operation which was simple, and safe, and which provided excellent drainage, but, of course, had the obvious disadvantage of leaving urinary fistulæ on the skin surface with the attendant discomfort of these.

[*April* 27, 1927.

The Medical Aspects of Hæmaturia.

By Sir THOMAS HORDER, Bt., M.D., F.R.C.P.

THE title of this paper is rather a misnomer, for it suggests that cases presenting this very common and important symptom can be divided into two classes: medical and surgical. I suggest that the condition of hæmaturia demonstrates—what I take it we all believe—that, in the first instance at all events, all patients are both potentially medical and surgical: that is to say, they are suffering from pathological conditions, and we do not know at first—sometimes we do not know at last—whether these conditions lie chiefly in the province of the surgeon or of the physician. Several types of hæmaturia in their causation interest mutually both sides of our work—nephrolithiasis, for example; tuberculosis; urinary tract

infection; neoplasm: all of these are conditions which frequently give rise to hæmaturia, and they all have both medical and surgical bearings.

Still, I think it is clear what is intended by the title, and I do not propose to deal with certain forms of hæmaturia which are essentially surgical in their aspects. Trauma, of course, is outside my sphere; so also is neoplasm when it is operable; also calculus of the gross kind giving definite indications for nephrotomy or nephrectomy; again, tuberculosis when the primary condition is renal, as it nearly always is, and radical measures can be employed by way of excision, partial or complete. Further, certain anatomical defects in the vessels and in the position of the organ, when these are diagnosed as being the cause of the hæmaturia, are outside the sphere of the physician. But I would like to stress the point that hæmaturia is a symptom which in many cases calls for an approach from both the medical and the surgical aspect in investigation, and very often also in treatment.

As regards definition, I take it that the word as we use it this evening has no reference to microscopic amounts of blood or even to specimens of smoky urine, but to the grosser condition in which blood is present to the naked eye as blood, and at some periods in considerable amount.

I thought it might be useful, as giving me certain types of cases to discuss, if I took a list of cases of hæmaturia of the kind I have just mentioned—gross, frank hæmorrhage—in patients, male and female, who have been in my medical wards, during the past five years, and have therefore been under my own observation, some of them jointly with my colleague Dr. Gow. I have had tabulated the cases—fifty-four in all—in which during the last five years hæmaturia has been observed either as the main symptom or as a very important and striking symptom. The final diagnoses with regard to these patients were as follow. Out of the fifty-four cases, twenty were diagnosed as acute nephritis—nearly one-half the cases, therefore, during these five years have been of this nature—seven were cases of chronic nephritis, four of renal calculus, four of infective endocarditis, three of urinary tract infection, two were suffering from mitral stenosis, and presumably therefore had renal infarction, two were cases of purpura, and two were thought to be prostatic in their origin. There was one of each of the following: Addisonian anæmia, an interesting case of polycythæmia (Vaquez' disease), hæmaturia following on administration of hexamin in the treatment of encephalitis, and hæmaturia thought to be due to intensive salicylate treatment. There were also five unclassified cases, and of these five cases I think two come into that ill-defined group of hæmaturias which have been called "essential hæmaturia."

I will comment briefly upon each type of case in which hæmaturia is a common feature. Acute nephritis is obviously by far the commonest disease in which patients come to the physician with hæmaturia at the present day. We are still without accurate knowledge, however, as to which sort of infection is most likely to produce a hæmorrhagic type of urine. It used to be thought that scarlatinal nephritis was highly hæmorrhagic in its character. I do not know that that has been borne out by later experience. Then it has been suggested that pneumococcal infections are highly hæmorrhagic. I cannot say from my own experience that I have confirmed that statement—indeed, as I said, I am unable to say from my own experience in which infection—whether with streptococcus or pneumococcus or *Staphylococcus aureus*, or other organism—a bleeding tendency is more likely to be produced; with regard to this point I should like to know the experience of others. Exacerbations in acute nephritis with hæmaturia are rather a striking feature, and come within the familiar experience of the physician. To what are these exacerbations due? Are they due to re-infection or re-intoxication of the kidney from the presumed focus, or are they due to some changes taking place in the kidney and not necessarily

due to hæmatogenous influences? I used to hope—and I hope still—that upon watching these cases of acute nephritis very carefully, making a re-survey every time these crises occur, we might obtain a guide in tracking down the cause of the nephritis, but I have failed in this. These crises, which, by the way, are generally pyrexial and associated with a little exacerbation of the toxic symptoms—with rather more headache and drowsiness—gradually fade out of the picture, and with patience and persistence in the old-fashioned methods of treatment—namely, rest, with vicarious functioning of the skin and of the bowel—most of the cases get well. But I should like to know whether anyone has some evidence or experience showing what is the exact mechanism of these crises.

Another question which not infrequently arises in cases of acute nephritis is, when should septic tonsils be removed, assuming that they are a feature of the case and the practitioner is led to the conviction that they are associated causatively with the disease? I think we used to wait longer than we are inclined to wait now. I do not wait very long, even in the presence of hæmaturia. The pathogenesis of the case of acute nephritis in which there is no faucial or other recognized source of infection, or site of focal sepsis, is very baffling. Again and again one finds these cases admitted to hospital—children, the majority of them—and the past history, the present condition, and a thorough survey of the whole case, leave a complete blank as to the nature of the infection. There are all sorts of theories, but none of them are borne out by bacteriological or other evidence.

With regard to chronic nephritis, I do not consider I have anything to add to the accepted views, that there are two conditions in which bleeding may occur. The first is chronic parenchymatous nephritis—that is to say, tubal nephritis with considerable œdema, a tendency to chronic uræmic symptoms, and cardio-vascular changes which are not very marked. It seems to take very little in the way of sub-infection in a patient subject to latent parenchymatous nephritis to produce hæmaturia. The second type is the so-called chronic interstitial nephritis, granular kidney, or contracted kidney, with high blood-pressures, and marked cardio-vascular changes. Patients with this condition are subject from time to time to rather frank and definite bouts of hæmaturia and these are not associated with sub-infection. These facts are borne out by a study of the cases which have occurred in my wards. The term "renal epistaxis" has been rather diverted from Gull's original meaning to a group of cases called "essential hæmaturia," to which I shall make reference later. There is no reason why the term "renal epistaxis" should not be applied to a form of kidney bleeding which is not associated with marked vascular changes, but that was not the original meaning of the expression.

Some authorities state that if a chronic nephritis is syphilitic in origin bleeding is more prone to occur. To judge by the positive Wassermann in cases of chronic nephritis, if that can be taken as a guide to cases which are syphilitic, there was, in the four cases of which I have notes, no special tendency to bleeding. Nevertheless, it is sometimes said that syphilitic patients tend to a hæmorrhagic type of nephritis if the kidney is affected.

With regard to renal calculus, I sometimes wonder whether we should diagnose renal calculus in the absence of hæmaturia, assuming that radiological findings are negative. If these findings are negative and hæmaturia has not occurred, I do think it is questionable whether pain—even pain that seems to be strikingly like renal colic—should be regarded as the result of calculus. In the four cases in this series that I have had under observation, all showed good evidence, either by radioscopy or by nephrotomy undertaken for the purpose of clearing up the diagnosis; but when I come to the cases that are unclassified it is obvious that some of these may have been due to calculus. I have here a caution to enter, which one of my cases taught

me. I overlooked a large calculus in the kidney for a considerable time in the case of a woman who had a gross coliform infection with symptoms of dysuria and with hæmaturia. She had no renal pain, her kidney could not be felt, and, as it happened, she was not X-rayed for a considerable time. The trouble was not a new growth, but a kidney which had been for years disorganized by the presence of a large calculus. It is a thing to beware of in a case in which infection is very easily demonstrable, and is such as to give rise to hæmaturia, that calculus may be present as well as the infection.

That brings me to acute infection of the urinary tract—another group of cases common to both physicians and surgeons. In one of these cases there was a high temperature—104° F.—dysuria, and very copious bleeding. I think that in this country we are aware of the frequency, or at all events the definiteness, of hæmaturia as an early sign—perhaps the first sign—of coliform infection of the urinary tract; but, all the same, I wonder how many such cases are still thought to be tuberculous. If epididymitis occur, and it sometimes does, that tends to turn one's thoughts still more in the direction of tuberculosis.

In one of these cases there was a papilloma of the bladder in addition to the infection—a very deceptive case. The woman had had chronic cholecystitis for some time before she came under observation at St. Bartholomew's Hospital. She had hæmaturia and a urinary tract infection that was quite marked; but Mr. Ball demonstrated by cystoscopic examination that in spite of all this there was a definite papillomatous condition of the bladder, in a small area actually involving the right ureter.

Like the case of calculus already mentioned, here is another possible source of hæmorrhage to bear in mind in cases of infection. That reminds me that although I have not such a case amongst this series, I have seen a case privately, and have been partly responsible for the demonstration after nephrectomy, of papilloma of the renal pelvis; so that one should be on the look-out for this double cause of hæmorrhage—papilloma in the pelvis of the kidney or in the bladder, plus the coliform or other infection of the urinary tract.

Two of my cases were labelled prostatic. The patients were men aged respectively 64 and 74 years, and the diagnosis was not entirely on my responsibility. A surgical colleague agreed that the probable cause of the hæmorrhage was the prostate, not malignant, rather soft in one case, and with an unusually large intravesical projection. One of these patients—the man aged 64—had a systolic pressure of 190, and a diastolic pressure of 90, so that possibly the hyperpiesis may have increased the tendency to bleeding.

I come now to a more definitely medical class of case—hæmaturia in association with heart disease. There are three forms of heart disease illustrated in my group. The first is septic endocarditis. As I said at the beginning, I am not concerned with the discovery of a few red blood-corpuscles in the urine. That is very important, as we all know, in the diagnosis of septic endocarditis—a very early symptom and a very constant symptom, and one which calls perhaps for daily microscopical examination of the urine over a period of a week or ten days. The pathological condition underlying it is well known, and has been described by Gaskell and others. I am not, however, referring to that, but to frank hæmaturia, the result of embolism. Sometimes the hæmaturia is unusually prolonged, lasting for weeks, because the embolus is a septic embolus and sets up a septic focus in the kidney. The condition is usually painless.

But in one of my cases of infective endocarditis—a girl of 18—the patient suffered great pain. Her pain was so severe that I thought for some time there must be some other feature than septic infarction. She complained bitterly of the pain, and once or twice it was so great as to require narcotics. But when she died in hospital of cerebral embolism there was nothing found post mortem to cause this pain except the renal infarction.

The second form of heart disease in which hæmaturia occurs is mitral stenosis. Here, again, the cause is renal infarction. In addition to septic endocarditis and mitral stenosis, there is dilated heart. Patients with chronic cardiac dilatation and chronic renal congestion sometimes have quite a large amount of blood in the urine.

I now come to certain blood states. In this series were two cases of purpura, both of them of Henoch's type. They were children, one of whom is still under observation in the hospital, and has been for a considerable time—three months—and is still bleeding. He is a small boy aged 14 whose illness began ten days before he came to hospital, a few days after eating skate. He vomited and had a rash; a very diffuse petechial eruption was present over the arms and legs, with a few spots on the abdomen; he was very listless. On admission his abdomen was retracted, tender, and he had a little pyrexia. At this time he had no blood in his urine, though in it there was a little albumin. He gave a history of having had severe abdominal pain on two occasions preceding this, but there was no history of bleeding. He was put on salicylates when admitted on December 27. On January 17, for the first time, there was a considerable amount of blood in the urine. On the strength of what one knew to be a fact, namely that salicylates occasionally produce hæmaturia, he was taken off the salicylates, but the hæmaturia persisted. He was also attacked with œdema of the hands and forearms.

The relation of purpura to hæmaturia is very complex. The kidney may bleed as an expression of the purpuric state: the toxic element causing the purpura may cause the kidney to bleed. But hæmorrhages into the kidney themselves cause renal changes very closely allied to, if not identical with, nephritis, so that it is sometimes very difficult to say what is the sequence of events. This boy had large tonsils which it was thought were septic. In the other case of Henoch's purpura the patient had three attacks of hæmaturia with abdominal pain, and then the condition seemed to clear up.

The case of polycythæmia (Vaquez' disease) was very interesting. It was that of a woman who had been under observation several times in St. Batholomew's Hospital and in private—a very typical case of the disease. She had had retinal hæmorrhages. She had also an arterial block, I thought, in the artery to the left big toe, where there was commencing gangrene which necessitated amputation. Three months after this amputation of the left big toe, she was sea-bathing at Eastbourne, and this was followed twelve hours afterwards by an attack of hæmaturia which persisted for six weeks, indeed up to the time of her death. It was a very intractable hæmaturia. The loss of blood was so considerable as to reduce what had been a polycythæmia to figures which were just above those of a normal blood count.

Dr. George Graham will remember the case because, four years before this event, he helped me in giving the patient continuous inhalations of oxygen. We demonstrated that the blood state of these patients is not improved by this measure.

In this series there is only one case of hexamin hæmaturia. I think there was no doubt about the causation. It was a case of acute encephalitis. A post-mortem examination was made eventually. The patient had been given only a moderate dose—20 gr. six-hourly—and at the end of the third day there was a profuse hæmaturia.

Now I come to the unclassified cases. There were five of these, and I have already said that I feel sure that one or perhaps two of them would be put down as "essential hæmaturia" by those who consider that there is a group of cases to which we might attach that provisional label.

One of the unclassified cases was a patient with aneurysm of the thoracic aorta; she had a profuse hæmaturia four days before death. The second of the unclassified cases might possibly be regarded as a case of calculus or nephrolithiasis. Then there was the case of a boy of 18 whom Mr. Ogier Ward sent to me from St. Peter's Hospital. I failed to make a diagnosis. Mr. Ball was able to say that the blood came from one kidney only and not from both.

But we know that in some of these cases of hæmaturia without obvious cause it is on one side only that bleeding takes place. That is no guarantee, however, that if

nephrectomy is performed on that side a similar condition may not start in the other kidney.

But perhaps the most typical case of what is termed "essential hæmaturia" was that of a man of 33 (looking up the literature I find that in the cases coming into this loose group of hæmaturias the patients are generally between 20 and 40 years of age), a cycle-maker, who, in 1921, passed blood in his urine. He was cystoscoped without anything abnormal being found. In November of that year he had a certain dull, not acute, pain, but nothing was done, because again nothing further was found. In January, 1922, he had a short attack of hæmaturia with no other symptoms. When he presented himself at the hospital a third time the left kidney was explored, but again with negative findings. He bled a little in February, 1922, and then nothing happened until he came under observation at St. Bartholomew's Hospital, in March, 1923. There was no event in his past history or present condition that suggested any reason for this tendency to bleed. Radiology was quite negative, he had no dysuria, there were no signs of arterial changes, no hyperpiesis, no albumin or mucus in his urine. Conveniently for our purpose, he had an attack of hæmaturia while thus under observation, but the examination of the urine showed merely that there was a good deal of blood, a few blood-casts, but no other casts, and the condition cleared up rather quickly; within a week his urine was normal again. I do not know what has happened to him since, but that is what I regard as an example of a type of case which goes by the name of "essential hæmaturia."

It is easy to say that these are cases in which we do not know the cause of the hæmaturia, but it is a striking fact that in some patients bleeding from the kidneys occurs somewhat easily and without obvious cause. The matter has been written about a good deal, not much in this country, although Hale-White[1] has published a paper on it.

I have seen one case of this type in private. The bleeding was so profuse that everybody was alarmed, and said that something must be done; but everything had been done except nephrectomy, and eventually that was done. I failed completely to find anything wrong with the excised kidney, and I was particularly keen on one or two points which had been brought to my attention: one was the study of the pelvis in view of the possibility of minute papillomata, and the other was the so-called nævoid condition in the kidney substance itself.

Hale-White said that there was no satisfactory explanation of these cases; he uses the term "renal epistaxis" for them, and came to the conclusion that there are two factors, one an undue ease of bleeding from the kidney and the other some toxic state at present unknown.

In my list there does not happen to be an instance, curiously enough, of tuberculosis, or of drugs other than hexamin. The condition has been brought on by use of carbolic ointments and lotions, and there is our familiar friend rhubarb, to which some patients are susceptible. I have also no instance of bilharzia hæmaturia. I thought, however, it might be useful to take actual cases as a basis for these rather discursive remarks.

Discussion.—Mr. GIRLING BALL (President) said that Sir Thomas Horder's remarks had illustrated the desirability of collaboration between physicians and surgeons in such a field as this. Many cases which used to be called essential hæmaturia were now, as a result of more perfect methods of investigation, classified in other categories.

Dr. GEORGE GRAHAM said it was remarkable that in cases covering five years in the medical wards there should not have been an instance of oxaluria. A case of hæmaturia in an elderly woman had come under his observation and there had appeared to be nothing to account for the condition except the fact that she had been eating a great deal of ginger. The oil of ginger, though nothing like so potent as turpentine, was said to cause hæmaturia.

Sir JOHN THOMSON-WALKER said that it did not seem to have been brought out quite clearly whether hæmaturia was the primary or most important symptom, or was only a secondary symptom. At the same time, having had doubts on the subject, he had been convinced by Sir Thomas Horder that there were medical cases of hæmaturia or medical

[1] *Quart. Journ. Med.*, 1910-11, iv, 509.

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aspects of the condition. Sir Thomas Horder, in speaking of the prostate, had rather appeared to imply that more hæmorrhage was likely to occur in a malignant prostate; but, in fact, hæmorrhage occurred much more easily and freely from a large œdematous prostate than it did from a malignant prostate.

Mr. HUGH LETT said that in his experience the very worst hæmorrhages in connexion with the enlargement of the prostate occurred in cases in which stone was present in the bladder as well.

Mr. SWIFT JOLY asked whether in chronic interstitial nephritis it was the common experience to find the bleeding unilateral. He had cystoscoped three of these cases, and in all of them the bleeding came entirely from one kidney.

Mr. NITCH said that he knew of one man who by accident was given a concentrated solution of hexamine, receiving 480 gr. of the drug, and it did not have the slightest effect in causing hæmaturia.

Sir THOMAS HORDER (in reply) said that he agreed with Dr. Graham that either oxalic "storms" were not as common as they used to be or that our views of the significance of oxalic crystals in the urine had altered; he was not sure that years ago they did not take the presence of such crystals too seriously.

He accepted the compliment that Sir John Thomson-Walker had indirectly paid him when he made it clear that although he came there not realizing that there was a medical aspect to hæmaturia he was now converted to this recognition. The physician saw all cases of hæmaturia as medical cases until he proved them to be surgical, but the surgeon saw all cases of hæmaturia as surgical until he proved them to be medical. Provided both physician and surgeon pursued their respective methods of approach to the bitter end, the patient got the benefit either way!

There was no connexion, of course, between his remarks that evening and his earlier paper of some years ago (on renal decapsulation) to which Sir John Thomson-Walker had kindly referred. He had been speaking on that previous occasion of a particular type of nephritis which he thought was eminently amenable to surgical treatment. That was quite a different type of case from any he had been discussing that evening. Referring to areas of fibrosis in kidneys removed on account of bleeding: might those areas not be the result of the bleeding into the kidney rather than the cause of it? Of course, if these patients bled from the pelvis, then any changes found microscopically in this situation after the kidney was excised, or found post mortem, might be regarded as presumptive evidence that this lesion was associated with the bleeding. But if the bleeding occurred into the kidney substance, might not the fibrosis found afterwards be the effect of these hæmorrhages?

With regard to the fact of congenital cystic disease causing hæmorrhage: he had not seen a severe hæmorrhage in congenital cystic disease. He supposed if one felt that the patient was dying from the hæmorrhage one would be justified in asking one's surgical colleague to remove the affected kidney, even with the knowledge that the other kidney was diseased, as indeed, it always was.

Mr. Joly referred to the fact that in chronic interstitial nephritis, the hæmorrhage was unilateral at times; he would be interested to know of Mr. Joly's experience. He had not himself obtained proof that such unilateral bleeding did occur, but he was not surprised to hear of it. He would suggest that probably this was more often the case than not, for surely "renal epistaxis" was rather a symptom of diseased arteries than of diseased kidney tissue. So also with cerebral hæmorrhage. The patient suddenly developed hemiplegia, as a result of cerebral hæmorrhage, when he had considered himself to be quite well.

JOINT DISCUSSION No. 8.

Section of Anæsthetics and Section of Odontology.

Chairman—Dr. Z. MENNELL, President of the Section of Anæsthetics.

DISCUSSION ON ANÆSTHETICS IN DENTAL OPERATIONS.

Dr. H. BELLAMY GARDNER.

ALTHOUGH in opening this discussion I venture to advocate a definite line of procedure, it should not be assumed that there are no exceptions to its application, but I believe that future developments in the dental surgeon's equipment will tend to its more general adoption and that experience proves other methods to be at fault. First, then, I consider that the best place for a dental operation is the dentist's surgery and that the patient should be seated upright in a dental chair. Secondly, general anæsthesia induced by the continuous nasal administration of nitrous-oxide and oxygen, for operations of from ten to fifteen minutes' duration, and the nitrous-oxide, ether and continuous chloroform sequence, with a Junker's apparatus, for longer operations, or for those in which the former anæsthetic is unsuitable, meet the necessity in the greatest number of cases.

This system provides a continuous anæsthesia in the attitude to which the dentist is accustomed, uninterrupted by re-application of face-pieces and, if carried out with skill and attention to detail, it is attended with the minimum of after-effects. The method is, of course, in general use for the shorter operations ; but the resort to nursing homes for the performance of the longer operations breaks down as a system under the test of experience. In these cases the patient might engage a room at a nursing home near the dentist's consulting rooms, but should as a rule go to the dentist's surgery for the actual operation, using the nursing home as a hotel, which provides a nurse to accompany him to the dental surgery and back to the home for after-attendance.

The procedure for the administration is as follows : the patient is seated upright, well back in the chair with his feet *on the floor*, one on each side of the foot-rest. A stout leather band is passed round his hips and beneath the chair, and is fastened by a buckle ; this ensures that the upright position will be maintained. The head-rest is adjusted to support the occipital protuberance. He is then requested to blow his nose, so that there may be no discomfort as he goes to sleep, and then to clasp his hands together and rest them in his lap. The heart should be auscultated in every case.

Next, the dentist may now indicate to the anæsthetist the situation and number of the teeth to be extracted and should, if possible, arrange to complete the extractions on the left side of the mouth first, so that as the Hewitt's mouth-prop has been placed on the right side while extractions have been done on the left, the anæsthetist may be able to adjust another prop there, or the Mason's gag, that is, on the side next to himself, instead of attempting to insert a Mason's gag on the further side—an almost impossible task while conducting a nasal administration.

During induction of anæsthesia it is of great advantage to talk to the patient, directing him to breathe slowly and naturally and allowing time for even diffusion of the anæsthetic, thereby dispelling the fear, which is universal, of being operated upon too soon, and the other mistaken supposition, that one ought to be unconscious

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after one or two breaths. All conjurers are allowed a little "patter" to divert attention from their essential movements.

Suitable bleached honeycomb sponges, the size of an orange, should be provided to protect the upper air-passages, and one of them placed in the mouth before the dental operation begins.

The assistance given by the anæsthetist should consist of: counter pressure on the head or mandible; sponge-pressure on the gums after each extraction to facilitate the view and to prevent invasion of the throat by blood; and forward traction on the angle of the jaw to maintain a clear airway if required. Should the base of the tongue tend to fall back, a sponge held with forceps may be inserted behind it and rotated gently backwards; this will draw the tongue forward by causing its soft tissues to move in the opposite direction to the sponge, like two wheels in contact by their edges.

When the left side of the mouth has been dealt with it should be packed with a sponge and the fresh prop should be adjusted. It must be remembered that in his adjustment of the dosage the anæsthetist must be guided by the *colour* of the patient's lips, and that no change should be made from one kind of artificial light to another, or from daylight to artificial light, during an administration.

The new blue lights are bad for the administrator, as they do not show the gradations between pink and purple so clearly as well-diffused electric lights. A searchlight upon the mouth alone constitutes a positive danger, by plunging the surrounding instruments into such darkness that they cannot be discerned when required.

When the operation is completed the mouth sponge should be removed first, i.e., before the mouth prop; I have known attempts made to swallow a sponge when the patient was in the half-waking state.

Shading the eyes and talking very quietly to the patient, during recovery from the effects of the anæsthetic—telling him where he is, and so on—will often prevent a bad dream. He should be made to bend forwards for a few minutes to counteract a possible reactionary fall of blood-pressure which may occur as the effects of the anæsthetic wear off. During this time he might be washing out his mouth, until he is allowed to sit up.

When ether has been the anæsthetic employed the chair may be adjusted to the couch position and the patient remain recumbent until consciousness returns, with both sides of the mouth packed with sponges and the mouth props still in place.

In the employment of any of these anæsthetics the minimum of after-effects is obtained when not the least obstruction to breathing is allowed to take place.

In an alcoholic or powerful muscular subject an excellent nasal gas-and-oxygen anæsthesia may often be induced after a preliminary dose of $\frac{1}{4}$ gr. morphine, as the morphine prevents the bad dreams which constitute the main source of difficulty and cause the inconvenient movements in these cases.

I believe that gas-and-oxygen may safely be administered by the continuous nasal method to practically every person who can walk up a few stairs without difficulty. The exceptions are those who have had cerebral hæmorrhage or who are the subjects of true angina pectoris. The paralytics should be left entirely alone, or, if the extraction of a tooth is absolutely necessary, a little ethyl chloride may be used as a local spray. The anginal subject should be treated at his own home, lying on a couch, and chloroform only should be the anæsthetic employed.

Mr. Ivan S. Spain.

The subject of anæsthetics in dental surgery is a very wide one, but this discussion to-night is to be on general anæsthetics only. It seems to me that for dental operations there are a number of decisions which, although ethically the duty

of the anæsthetist to make, have to be made by the dental surgeon. The most important of these is the choice of the anæsthetic. In the case of patients between the ages of 10 and 65, for dental operations which can be completed in any time under four minutes, there is no doubt in my mind that N_2O and O administered nasally is not only the best but almost the only anæsthetic that should be used. Over the age of 65 I sometimes hesitate to advise the nasal method of administration for simple cases. My experience has been that there is undoubtedly more strain on the patient in this method than in the ordinary face administration; therefore I should advocate the use of simple face gas for such patients. For children under the age of 10 or 12, gas and oxygen, either by face administration or nasally administered, is not in my opinion so satisfactory, and the younger the patient the more unsatisfactory it becomes. In these cases it is necessary to remember that we must avoid anything which might frighten the child and thus create a stumbling-block in the way of future dental operations. I have therefore come to the conclusion that it is far more satisfactory, even for short operations in these cases, to advise the use of chloroform and ether administered by the open method at the patient's own house.

I do not like ethyl chloride as an anæsthetic administered alone. I can see no advantage over gas and oxygen for a short anæsthesia, or any advantage over chloroform and ether for a long one. For all cases likely to take longer than five minutes to complete, and which must be completed at the time, I would always advise the use of chloroform and ether followed by ether alone in a nursing home. If the anæsthetist can be persuaded to use the intratracheal method, so much the better. I am not altogether in agreement with Dr. Bellamy Gardner in his suggestion as to the necessity of these operations being done in one's own surgery. It need not be difficult to take all the instruments required, even to the extent of a portable dental engine for drilling bone. The advantage of not having to move the patient after the operation seems to me considerable. With regard to the actual dental operations themselves, I am entirely in favour of using the dental chair for the purpose, whenever possible, provided always that the chair is a satisfactory one and the light good. Failing this I am quite content to do any dental operation on the operating table under the usual head light provided for that purpose.

Referring again to the use of gas and oxygen nasally, for a short dental operation, there are a number of small points which add very much to the comfort of the patient and to the success of the operation. The dental surgeon has the advantage of seeing the patient before the operation, and also of hearing the patient's comments afterwards, and one learns that although two anæsthetists may produce an equally good anæsthesia, the patient will criticize one very severely and will praise the other with equal enthusiasm. The principal grievances that the patients have against either the anæsthetist, or the dental surgeon after a comparatively short dental operation under nasal gas and oxygen, are: (1) that they felt suffocated at the commencement of administration; (2) that their lips or cheeks were bruised or damaged in some way or other; (3) that on recovery from the anæsthetic there was a considerable feeling of nausea and faintness lasting perhaps some considerable time.

The question of the feeling of suffocation by the patient during the induction of anæsthesia does not, I think, arise on account of nitrous oxide being used without oxygen, for that feeling of suffocation is not entirely prevented by the use of oxygen. I am quite sure that it is due in every case to the too sudden use of pressure in nasal administration, or to the early covering of the mouth in the case of patients who show disinclination to breathe through the nose. I am convinced that in 80 per cent. of the cases this covering of the mouth can be entirely avoided. If the nose-piece is placed lightly on the patient's face and the nitrous

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oxide, either alone or with oxygen, is blown gently through it, the patient can be encouraged to breathe in and out of the nose and will, without any trace of feeling of suffocation, reach the first stage of anæsthesia before the mouth need be covered in any way. With the excitement stage of anæsthesia violent mouth breathing may of course occur, and the mouth can then be covered up, but mouth breathing at this stage is far less likely to happen if undue pressure on the nose be avoided during the early part of the induction.

With regard to the second difficulty, that is the damage to the lips or cheeks caused by either the use of a Fergusson gag or mouth-opener, or injury to the patient's lips by the dental surgeon, I think it is invariably advisable for the dental surgeon himself to operate the gag as he is standing in front of the patient, and can see what he is doing, and he should use this gag only as a means of placing in position another mouth prop to enable him to proceed, on the opposite side of the mouth. This method not only has the advantage of giving him additional room to work in, but it also allows the anæsthetist to have both hands free during the administration of the anæsthetic. No position seems to me so hopeless as that in which the anæsthetist, holding the nose-piece with one hand and the mouth-opener with the other, and standing behind the patient so that he is entirely unable to see what is happening in the mouth, endeavours to regulate the oxygen supply, and at the same time to steady the patient's head. Another duty which is usually taken on by the anæsthetist in these cases is the use of the swabs or sponges. I maintain that the operator is better situated to place these sponges in the right position at the right time, and it should be his duty to keep the pharynx free from blood through the whole of the administration. I, myself, am quite satisfied if the anæsthetist can provide four minutes' peaceful anæsthesia by the nasal method, in itself by no means an easy task, and leave me to do the rest. The only other service I should require of him would be to keep the patient's head steady and in the correct position.

The question of the reason for sickness after the use of gas and oxygen is very difficult to answer. I have thought it due to too much or too little pressure, too much or too little oxygen, too much or too little food prior to the operation, and I am unable to express any definite opinion on the subject. I feel sure, however, that one of the means of avoiding this trouble is to keep the patient at an even degree of anæsthesia—not too deep, and to avoid cyanosis. This brings us to the consideration of the advisability of the use of oxygen in nasal administration. I do not think that the absence or presence of oxygen has anything to do with the actual feeling of suffocation on the part of the patient, but I am convinced that a very much quieter and safer anæsthesia can be obtained by its use. In addition to this, it is possible in very many cases, with the use of oxygen, to overcome the rigidity so often seen in nitrous oxide anæsthesia; in this way the difficulty of any extraction is greatly reduced.

A final point is the position of the patient in the dental chair. We cannot take too much trouble to get the patients comfortable and maintain them in a position where they are the least likely to slip, with the head in a direct line with the body, neither pushed forward or stretched back; I strongly recommend the use of a strap to prevent the patient slipping out of this position.

The foregoing remarks deal with very ordinary and well-known facts, but if we may judge by the comments of patients we see, the percentage of successful cases is by no means so high as it should be.

Mr. I. W. Magill

said that more stress might have been laid on the value of endotracheal anæsthesia in long and difficult dental operations.

He (Mr. Magill) had found that this method provided the nearest approach to a physiological anæsthesia. The catheter was passed into the trachea through the nose, but better results were obtained when a second tube of rubber was passed into the trachea as well, in order to provide for expiration. In this way, no respiratory obstruction could arise from pressure on the lower jaw. He (the speaker) used a gauze pack in the mouth and removed the blood with a suction apparatus.

This method afforded greater control over the larynx and thus enabled the anæsthetist to maintain a much lighter and also a more tranquil anæsthesia, than did any other.

Mr. H. P. Baylis

said that in his opinion the dental surgeon was not at any disadvantage in extracting teeth with the patient on an operating table, but rather the contrary, especially if he stood upon a stool.

He (the speaker) had found ethyl chloride given on an open mask an excellent anæsthetic for children who, as a result of this method, had no subsequent apprehension.

Patients did not complain of feelings of suffocation with the nasal gas administration if the mouth was not covered until they were unconscious.

The dental surgeon should have the manipulation of the mandible in his own hands as much as possible.

Dr. S. R. Wilson (Manchester)

said that in no branch of anæsthetics were improvements more urgently needed than in that connected with dental operations. This was due to the fact that the dentist was labouring under the following disadvantages which did not arise in the case of the operative surgeon :—

(1) The operation was usually performed in the dentist's rooms or at the patient's house, and special attendants and operating accessories were not available.

(2) A detailed preparation of the patient was not generally possible.

(3) Neither the dental operation nor the anæsthetic was assumed to endanger life.

(4) The dentist had usually to work against time.

(5) The operation was in a region common to dentist and anæsthetist, and mutual adaptation was indispensable.

(6) The patient was expected to make a rapid recovery and to be able to return home after a short interval.

(7) The dentist's work was often looked upon as comparatively trivial, yet he was liable to be faced, without adequate warning, with an operation of such difficulty as would take a general surgeon, working under ideal conditions, more than an hour to perform.

These difficulties could only be overcome by intimate co-operation between the dentist and anæsthetist.

Proper packing of the throat was desirable in order to exclude blood and preserve a pharyngeal air-way, but sterile gauze was preferable to a marine sponge for this purpose. Auscultation of the heart was of little value. Demonstrable heart lesions were rarely dangerous. The real danger was a damaged myocardium only detectable, as a rule, by cardiac efficiency tests. Chloroform was not necessary in

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routine dental work. Whilst regional anæsthesia was very valuable in long operations, gas-and-oxygen analgesia was very useful as an adjunct, for it eliminated the passage of time and developed a pleasurable condition of the patient's mind.

The management of the gag and of the patient's jaws should be left to the anæsthetist, who, however, should never get in the dentist's way and should do his utmost to meet the operator's requirements.

Dr. H. E. G. Boyle

said that when anæsthetics were necessary in serious dental cases it was better to send the patients into a nursing home rather than to do the operation in a dentist's room and then let them go into a nursing home afterwards.

He (Dr. Boyle) entirely disapproved of the use of the stout leather band to which both Dr. Bellamy Gardner and Mr. Spain had alluded. In this connexion he remembered hearing a famous surgeon say, many years ago: "There are three anæsthetics used in this hospital—chloroform, ether and straps; this patient is having straps." The stout leather band was a reversion to an older and less desirable method.

He (the speaker) thought that if the patient was capable of going through his ordinary daily routine and came into the operating room without any obvious signs of distress, it was a mistake to insist on examining the heart, a procedure which only tended to make the patient afraid of the anæsthetic. With regard to placing large sponges in the mouth during a prolonged gas-oxygen anæsthesia, he (the speaker) thought that the modern practice of extracting the blood by means of a suction pump was far better and safer.

He (Dr. Boyle) could not agree with Mr. Spain that the after-effects of an extraction under local anæsthesia were slighter than after an extraction under gas-oxygen; he, personally, had found from experience, not only with himself but with others, that after a local injection the wound did not heal so well or so quickly as after an extraction under gas-oxygen. He was opposed to the administration of chloroform, or chloroform and ether, for dental cases, and felt that the most difficult dental cases could probably always be conducted under gas-oxygen-ether. He agreed that for small children ethyl-chloride was a good anæsthetic to employ.

The endotracheal method was unnecessary in the majority of cases, but when a large number of teeth were to be extracted, and the operation was performed on a table in a nursing home, he (the speaker) believed it to be the ideal method. He was sure that the feeling of suffocation of which some patients complained while being anæsthetized was entirely due to the gases being administered under too great a pressure. The great point to emphasize in all these operations was that of keeping the air-way clear; in his (Mr. Boyle's) experience, dentists, though unaware that they were doing so, generally impeded it.

He (the speaker) wondered why the anæsthetist was not called in to induce either anæsthesia or analgesia during painful fillings. He had been informed that when a patient was analgesic the dentist could not tell when the nerve had been reached. In a case of his own the nerves of several front teeth had to be destroyed; morphia with atropine was injected and the patient was then anæsthetized with gas, oxygen, aad a little ether in the dentist's room. As soon as she was "under," a catheter was passed down her nose and the anæsthetic was continued through the pharynx. The operation was then begun and lasted for about forty minutes; after about six minutes the ether was cut off entirely and only gas-oxygen was administered. Twenty minutes after the conclusion of the operation the patient was well enough to be driven home.

Dr. F. E. Shipway

said he could confirm the statements that ethyl chloride was an excellent anæsthetic for children, and reasonably safe. It had been used in the Orthodontic Department of Guy's Hospital in over 1,300 cases for children up to the age of twelve years; the open or semi-open method was preferred. There had been no fatality. He (the speaker) disagreed with Dr. Gardner as to the wisdom of conducting any operations, beyond those of simple extractions under gas and oxygen, in the dentists' consulting rooms; those dental operations which came under the heading of surgical operations should be performed under surgical conditions, and in a suitably equipped nursing-home, and the patient kept in the home until recovery was assured. The feeling of suffocation during nasal administration was due to lack of oxygen; obviously it could be avoided by fitting the nose-piece loosely over the nose so that air was mixed with the gas, or by giving a sufficiency of oxygen. He himself preferred the latter method, as it enabled the anæsthetist to increase the percentage of gas. He would like an explanation of the after-effects, sometimes distressing, which not infrequently followed a prolonged nasal administration of gas and oxygen. He realized that they might in some cases be due to an asphyxial element, in others to prolonged fasting, and in others to swallowed blood, but he would much like to hear what Dr. Gardner, with his large experience, had to say upon this point.

Mr. C. Schelling

said that Mr. Spain had applied the word "certain" to nitrous oxide and oxygen anæsthesia, but, during an experience of over forty years, he (the speaker) had several times had occasion to be grateful to skilled anæsthetists who from both "gas" and "gas and oxygen," had changed over to ethyl chloride, and so enabled the proposed operations to be completed at one visit. The patients in these cases had not been noticeably alcoholic or otherwise unusual.

Mr. Frank Coleman

said that a method which produced a good anæsthesia lasting for a quarter of an hour or more and followed by a satisfactory recovery, and one which could be employed while the patient was in the dental chair, consisted in giving nitrous oxide followed by ether, administered nasally. This method had, he thought, been chiefly employed by Dr. C. J. Loosely. He (the speaker) had found it valuable in those cases of tooth extraction which required either a full surgical anæsthesia with ether or chloroform, or a mixture of these, or else the division of the operation, where practicable, into two or more shorter operations which could be conducted under nasal gas. This method was interesting to him (the speaker) from a historical point of view, as when his father, Mr. Alfred Coleman, introduced the present nasal method of administering nitrous oxide in 1898, his original intention was to prolong the anæsthesia with ether, but as nitrous oxide alone was to be capable of maintaining anæsthesia the method was further developed with nitrous oxide alone and the reinforcement with ether had remained in abeyance, as far as he (the speaker) knew, until recently revived by Dr. Loosely.

Dr. C. J. Loosely

said that he claimed no new idea for his apparatus, but when he was House Anæsthetist at the Royal Dental Hospital he had felt the want of something rather more efficient than nitrous oxide. Though he had not then known of Mr. Alfred Coleman's experiments he had tried to adapt a Clover's ether inhaler to the nasal gas apparatus, but this had

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not been satisfactory, so he had designed a modification of it, with which he had obtained quite satisfactory results. As a test he had arranged for three patients who had on previous occasions given exceptional trouble under nitrous oxide—e.g., struggling and kicking and not becoming anæsthetic—to come up at the same time. With the ether attachment there had been no difficulty in keeping all three "under," in a placid condition, as long as was required. And each patient had risen from the chair and walked into the recovery room without sickness or difficulty.

The amount of ether required was very small. He generally put about an ounce into the receptacle and frequently found half of it remaining at the end of the operation. In selected cases, like those mentioned, it worked "like a charm" and never caused sickness. In those cases in which the difficulty was due to the dental condition rather than to the idiosyncrasy of the patient it was extremely useful in ensuring a sufficiently long anæsthesia. In such cases, however, the after-effects would be greater, though not nearly so great as if the patient had received a full dose of ether in the ordinary way. As Mr. Coleman had remarked, the method worked excellently in those cases which were too difficult to be undertaken with ordinary nasal gas in the dentist's chair, yet not so bad as to require sending to a nursing home.